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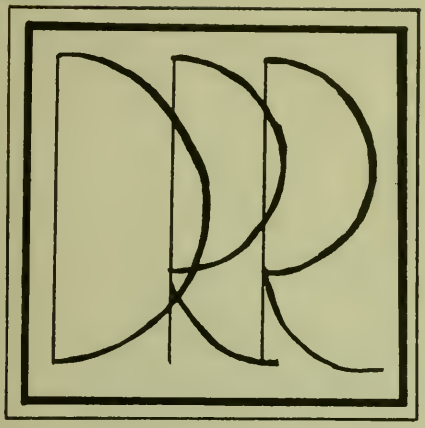

DIVISION OF RESEARCH RESOURCES

ANNUAL REPORT

FISCAL YEAR 1980

(October 1, 1979 - September 30, 1980)

National Institutes of Health
Bethesda, Md. 20205

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MISSION:

Identifies and meets the research resource needs and opportunities of the NIH by conceiving, creating, developing, and assuring the availability of those resources that are essential for the efficient and effective conduct of human health research.

Helps institutions establish and operate general clinical research centers where research studies can be conducted on patients over a wide range of human diseases; supports highly sophisticated biotechnology resources, such as computer centers, high voltage electron microscopy centers, and biological structure determination centers; supports primate research centers; increases and improves laboratory animal facilities and resources; makes awards for minority biomedical support, and provides institutional research support for stabilizing and developmental efforts among a variety of institutions throughout the United States.

Provides a unified approach to solving the many complex needs of health-oriented research that tends to be institutional, regional, or national in scale.

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REPORT OF THE DIRECTOR

Dr. Thomas G. Bowery

I. Report of the Director

The initial effort during fiscal year (FY) 1979 to develop a multi-year program plan culminated in success during FY 1980 with the actual production and distribution of a 140 page document entitled, Division of Research Resources Five-Year Program Plan, 1982-1986. In this document, DRR has set forth an array of more than 60 actions for research resources judged to be important to sustaining the momentum of biomedical investigations on a broad front of basic and clinical sciences. It is a plan about research needs and opportunities that delves into the pursuit, practice, and productivity of biomedical research by individuals and institutions as impacted by the availability and utility of resources. The architects of the plan have decided upon actions that respond only to the most solid core of the many research resource needs of scientists at extramural grantee institutions. Identified also in the plan are actions that involve policy issues of NIH-wide interest and concern.

In addition to the DRR staff, a number of groups of consultants have participated in the development of the plan over the past year. Throughout the planning period, members of the National Advisory Research Resources Council (NARRC) have been actively involved in program-specific work groups and as a collective body, providing ideas about, and advice on, priorities for actions that were under consideration. Significant contributions to the plan, including initial and continuing debate on issues, options, and opportunities for resources, came from the different program review and advisory committees serving DRR. Meeting on a number of occasions with staff and Council, they provided data, answered staff questions about needs, alternatives and priorities, and compiled panel reports to assist in the drafting of program plans. Other ad hoc consultant groups to the Division gathered and analyzed data and developed option papers for special initiatives. The real sum and substance of the DRR program planning creativity, however, arose, as it must, within the managerial realms of each program--the program directors and their scientific staffs. It was they who synthesized the ideas and drafted the DRR planned actions for new resource initiatives, as well as those future steps for either enlarging, enhancing, or closing down various existing resource activities.

During FY 1980, the working draft of the Five-Year Plan served as the base for the Division's Evaluation and Research Plan Review Session with the Director, NIH. In addition, the Plan served as the policy framework for the budget priorities developed for the President's Revised Budget for FY 1981 and the Division's Preliminary Budget submission for FY 1982.

In addition to contributing to the planning effort, the Office of Administrative Management carried out these important activities--

- Through a series of meetings with NIH and other Federal staff, we helped to explain the potential effects of two legislative proposals--H.R. 7036 (Health Research Act of 1980) and S.988 (Health Sciences Promotion Act of 1979)--on the DRR. While the fate of these two Bills is not now clear, the impact on this Division is now generally constructive.

- The National Academy of Sciences has completed a survey of laboratory animal facilities, transmitting the survey results to us. We in turn have alerted NIH to the need for a major effort in constructing institutional facilities for research animals.

- Extensive effort was devoted to the expansion of the DRR Management Information System. Individual subsystems to provide program-specific data and reports are now available to staffs of the Biotechnology Resources, General Clinical Research Centers, and Minority Biomedical Support Programs. Using these subsystems to analyze active grantees and contractors will help program managers to better understand the interactions between researchers and research resources, and to better plan for new research resources.

  Along with support for program management, much staff time and effort were devoted to the development of computerized capabilities to support the Division's budgeting process. For example, the criteria for a report which provides a forecast of DRR's future years' noncompeting continuation commitments as well as for the known or estimated competing continuation costs for all grant mechanisms and contract mechanisms were defined, using NIH's IMPAC as the data base. Also, the specifications for tables needed during the budget process were developed; those specifications were incorporated into an Autotab table system which is now used by top management in deciding budget increases and decreases.

  A third important area involved collecting and analyzing of all data from the 1979 DRR annual progress reports. The services of the Division of Computer Research and Technology's data conversion unit were used for data entry. Following normal editing processes, the data were made available to DRR Special Projects staff and were used to answer the many NIH scientific inquiries received.

  Finally, the Data Management staff were deeply involved in providing computer simulation support for this year's redesign of the Biomedical Research Support Grant formula allocation. This process, which is described in greater detail later in this report, allowed this Division to develop and recommend to NIH a new allocation formula which will return our distribution to the 1976 pattern.

- Our staff completed the final activities associated with the Government-wide three-year audit of position classifications. These activities have involved a complete investigation and review of all our position descriptions, reclassification of several, and out-placement of a small number of DRR employees into other NIH positions, thereby assuring retention of grades for the individuals. At the same time, the staff were also responsible for implementing the first procedures of the Civil Service Reform Acts; specifically, 18 DRR staff were subject to the provisions of the new Merit Pay System. In order to meet the requirements of this system, these 18 individuals entered into Merit Pay work plans, essentially contracts of work objectives to be accomplished during the year. At the end of the work year, performance appraisals were made for these 18 individuals, and commensurate salary increases were awarded.

- Several individual pieces of expensive office equipment have been leased for the past several years. In some cases, these leases were converted to purchase arrangements, thereby saving the Division several thousand dollars over the next three years.

- To the existing core of automated word processing equipment will be added several stand-alone word processing machines which have additional computer-terminal capability. These additions will be made in FY 1981 based on requirements identified at that time and a 1980-completed cost comparison study.

Other major activities within the Office of the Director centered in the Office of Science and Health Reports.

The Research Resources Information Center (RRIC) continued to expand its services and coverage of DRR activities during FY 1980.

The Office of Science and Health Reports established the Center in 1976 and has offered project and technical guidance since that time. The objective of the RRIC is to promote the awareness of, the value of, the utilization of, and the access to DRR-supported research resources.

The impact of the RRIC on the scientific community is evinced by the increased number of phone calls and requests from investigators and administrators in the field concerning the Center's services. Included were the dramatic increase in requests to be put on the Research Resources Reporter mailing list, requests for publication of notices in the Reporter, suggestions by DRR grantees for articles on new research developments, the assistance of a DRR resource on the filming of a new biotechnology process, response to the new OSHR-suggested "Research Services" section of the Reporter, and unsolicited comments by various scientists, educators, and administrators regarding the use of Reporter articles for actual lecture hall presentations.

The circulation of the Reporter has increased from 14,000 monthly at the end of FY 1979 to 17,000 at the end of FY 1980. Individual requests to be added to the mailing list now average 800 every three months. There are now 16 Reporter newsstands distributed at the NIH campus and associated NIH office buildings in Bethesda and at GCRCs in San Diego, San Francisco, and Torrence, California.

In addition to the monthly issuance of the 16-page Reporter, the RRIC completed the research, writing, and editing, with OSHR assistance, of two major special reports during the year. "The Seeds of Artificial Intelligence: SUMEX-AIM," a 74-page publication, containing 42 photos, charts and illustrations, was produced in March 1980; and the 32-page "Division of Research Resources 1979 Program Highlights" was produced in June 1980. In addition, the Center produced the following DRR directories during the fiscal year:

Biomedical Research Support	-- 1st edition
General Clinical Research Centers	-- 2nd edition
Animal Resources	-- 3rd edition
Biotechnology Resources	-- 3rd edition
Minority Biomedical Support	-- 3rd edition.

Recognition of the outstanding quality of the Center's products was made with awards to the Center and staff by two nationally known professional organizations: the American Medical Writers Association and the Society for Technical Communication.

In addition, the National Association of Government Communicators awarded First Place in Technical Publications to the DRR Information Officer for "The Seeds of Artificial Intelligence" at its annual awards luncheon. The awards to the RRIC for publications included:

Special Recognition - "The Seeds of Artificial Intelligence: SUMEX-AIM" Publications for Professional Audiences...American Medical Writers Association

Honorable Mention - Research Resources Reporter - Complete Periodicals... Society for Technical Communication

Third Place - General Clinical Research Centers Directory - Industrial Handbooks/Manuals...Society for Technical Communication

Articles in Reporter:

First Place - "Guinea Pig Models Human Diabetes" - Article, Magazines for Professional Audiences...American Medical Writers Association

First Place - "Guinea Pig Models Human Diabetes" - Periodical Articles... Society for Technical Communication

(Note: The above article was entered and received Honorable Mention in Society for Technical Communication International Competition.)

Honorable Mention: "The Problems and Promises of Artificial Intelligence" - Periodical Articles...Society for Technical Communication

Second Place - "Body Chemistry Fuels New Power Cells" - Periodical Articles... Society for Technical Communication.

As a result of a suggestion by the OSHR Information Officer, the RRIC, through Columbia University, is producing a 20-minute film on the CARTOS neuron-tracing system recently developed at the Biological Computing Facility for Image Processing and Display at Columbia. This film will be used as an instructional tool with the CARTOS loaner system and will also be shown at conventions and conferences of neurological and biotechnical societies. It will also be available at the Center for loan to medical centers and other institutions.

Considerable success was achieved during the year by OSHR in utilizing original Reporter articles for publication in other print media. Among those "recycled" pieces, which were placed by OSHR in slightly modified form, were:

Public Health Reports (Sept.-Oct. 1979) - Lyme Arthritis
NIH Search for Health column (Oct. 1979 - over 500 newspapers) - Diabetes Research in Pima Indians
Brazoport Facts (Dec. 1979) - Children's Milk Allergy
Children Today (Jan.-Feb. 1980) - Reye's Syndrome
News & Features from NIH (Jan. 1980) - Diabesity
JAMA (Feb. 8, 1980) - Diabesity
NIH Record (March 4, 1980) - Human Interferon by Macrophages
Federation Proceedings (April 1980) - Stable Isotope Resource

NIH Record (April 1, 1980) - Alcohol Abuse Causes Impotency
Children Today (May-June 1980) - Down's Syndrome
JAMA (May 2, 1980) - New Treatment for Myoclonus
News & Features from NIH (May 1980) - Alcohol Abuse Causes Impotency
Life & Health (June 1980) - Diabesity
NIH Search for Health column (August 1980) - Biomedical Research Support Program
NIH Search for Health column (Sept. 1980) - Alcohol Abuse Causes Impotency (Both in English and Spanish)

In addition to overseeing the RRIC's activities, the OSHR continued to create more visibility for DRR grant program activities during the year. For example, the OSHR successfully developed and executed a communication program for the University of California, San Diego, GCRC. The plan centered around a series of lectures called the Clinical Research Center "Health Science Tomorrow Lecture Series."

On October 3, 1979, the first lecture--"Fertility, Pregnancy and Birth"--took place in the main auditorium of the University Hospital. The lecture, conducted by GCRC-associated researchers, was attended by a cross-section of lay public residents in the San Diego area, in addition to medical center employees and their families.

On December 5, 1979, the second lecture--"Preventing Cancer, Heart Disease, Gallstones, Ulcers, and Intestinal Problems"--was presented to a near-capacity audience. The third lecture--"Nutrition's Role in Health and Disease"--was conducted to a "full house" on February 6, 1980. The fourth and final lecture--"Is Human Research Necessary?"--took place on May 1, 1980.

OSHR staffers personally participated in and gave overall direction for the lecture series with the cooperation of the San Diego GCRC administrators. A special tubular modular display unit was procured for use at their Annual Hospital Health Fair, and now remains on temporary loan in the lobby of the Medical Center. An extensive promotional plan to inform the public about the value of the GCRC included posters, table tents, and advance notices in the local press. In addition, a series of spot announcement slides with scripts was prepared by OSHR and sent to local TV stations. Radio stations also received copy for public service announcements.

Placements for numerous guest appearances on TV and radio were also made by OSHR for each of the events. Some of these placements include Drs. Alan Hofmann and Paul Jagger, GCRC co-directors, on station KGTV's "Public Pulse," Dr. Hofmann on KFMB-TV's "Sunup San Diego," Dr. Jagger on radio station KFMB's "Here's To Your Health," Dr. J. Edwin Seegmiller on radio station KSON's "Health Watch," Drs. Michael Wiseman and Michael Madigan on radio station KSDO's "Midday," and Dr. Drew Kelts on radio station KPBS-FM's "Afternoon San Diego."

Many stories appeared in San Diego area papers, and several were disseminated nationally over United Press International during the year.

A significant placement was made in the April 1980 issue of the San Diego Physician, the official publication of the San Diego County Medical Society. A 2-page GCRC story was "ghost-written" by OSHR for Dr. Alan F. Hofmann, co-program director of the GCRC, and placed with the magazine. The article describes the

history, facilities, and activities of the San Diego GCRC, and has been reprinted for use with the DRR modular exhibit at the Medical Center and for handouts at civic organization or other medical group presentations.

The promotional plan devised by OSHR for San Diego was intended to provide an example to other GCRCs throughout the country. OSHR has recently been contacted by GCRCs at the University of Michigan and the University of California, San Francisco, for assistance in conducting a similar series.

On January 15, 1980, the OSHR assisted in the 10th anniversary celebration of the GCRC at the University of Minnesota Health Sciences Center. In addition to print media coverage, the DRR staffers made radio and TV guest placements for CRC researchers on local stations. Dr. Frederick C. Goetz, GCRC program director, wrote in his letter of February 5th: "Thanks for all your help at our GCRC 10th Anniversary. Your professional assistance was great! The comments and interest we have received continue to be inspiring."

OSHR planned and held a media briefing in Birmingham, Alabama, on February 28, 1980, concerning the development of an effective screening procedure to detect a viral infection common to newborns, believed to be the leading cause of hearing impairment in the U.S.

The briefing, held in the University of Alabama Medical Center building, was attended by science and medical writers, and radio and TV representatives with their technical crews. In addition, during the briefing, a special conference call network was provided by OSHR to medical writers throughout the country. A 1½-minute video tape was prepared and distributed in advance by OSHR.

The resulting press coverage from this briefing was extensive. The story of the new "CMV" screening procedure was flashed over the United Press International, the Associated Press, and other national news syndicate service wires. Victor Cohn, prominent Washington science writer, wrote a feature for the Washington Post which was also distributed over the national Washington Post Service syndicate wire. The story appeared in hundreds of daily and weekly newspapers throughout the country.

An OSHR staffer served on the planning committee for the 8th Annual Minority Biomedical Support Symposium held in Atlanta on April 7-10, 1980. Once again, OSHR managed the press room for the symposium and handled all media activities surrounding the meeting. These included news stories, guest placements on local TV and radio, and national publicity and features which moved on Associated Press and UPI wire services.

Included in OSHR guest broadcast placements were Roma J. Stewart, director of the U.S. Office of Civil Rights; Nobel Laureate Dr. David Baltimore of MIT; Dr. Louis Sullivan, dean of the Morehouse College School of Medicine; and Dr. James Henderson of Tuskegee University.

On April 21-23, 1980, Drs. Jack Myers and Harry Pople of the University of Pittsburgh, demonstrated their computer diagnostic system, INTERNIST, at the American College of Physicians in New Orleans. Working with the communications office of the American College of Physicians, OSHR arranged a special demonstration for the news media covering the ACP meeting. In conjunction with this media demonstration, several other exclusive interviews were arranged for Dr. Myers.

OSHR also developed special flyers to promote the INTERNIST demonstrations to ACP members. "The Seeds of Artificial Intelligence," which describes the INTERNIST system, was made available to the press.

Mr. Mark Christmyer, public information officer of the American College of Physicians, wrote: "I think one of the reasons we were able to get such good coverage from the local media was due to the canvassing you (OSHR) did on the INTERNIST program."

Working with Dr. Daniel Knapp, manager of the CLINSPEC system at the Medical University of South Carolina, the OSHR designed and produced a tabletop exhibit for initial use at the American Federation for Clinical Researchers meeting in Washington, D.C. on May 10-12, 1980. The CLINSPEC exhibit is now on display at the University Hospital in South Carolina and will be booked into various national meetings throughout the year. A special CLINSPEC folder has been produced by OSHR for distribution with the exhibit.

On May 14, 1980, the first Dental GCRC was dedicated at the University of Pennsylvania, School of Dentistry. This event was conceived of and developed by OSHR. A 10-minute film about the dental research activity was produced by OSHR for viewing at the dedication. Clips from this original film were disseminated to TV stations for use on medical and health shows throughout the country. Among the media activities conducted by OSHR at the dedication was the arrangement of an interview for Dr. Irwin Ship with United Press International, placement of Dr. David Friedman on station WFIL-TV show, "For Your Information," and appearance of Dr. Ship on radio station WCAU.

During the past year, continued emphasis was placed on encouragement of grantee institution staff written feature stories on DRR program activities appearing in "house organs" with full DRR identification. Among those reported to OSHR were Center Times, University of Texas; Children's Center Fall Issue, Johns Hopkins University; Khatali News, University of New Mexico; Kaleidoscope, Scripps Clinic and Research Foundation; Health Sciences Record, University of South Carolina; Fairleigh Dickinson University Magazine; and the Southwest Foundation Reporter, San Antonio, Texas.

A feature story on a kidney-transplant patient at the University of Texas GCRC was written and placed by the Office with the Newspaper Enterprise Association. This feature, with a photo of Mr. Owen Dewing in the process of running "at least 45 minutes a day" was sent out over the "major wire" to 750 newspapers on February 2, 1980. Clippings on the story continue to come into the OSHR office from all over the country. "Owen Dewing is still running!"

Further multi-placements on DRR program activities included the story of the new baboon breeding colony at Southwest Foundation; a new dog lungworm discovery at Cornell University; an appeal from Dr. Philip S. Guzelian of the Medical College of Virginia for volunteer patients for a new pesticide poisoning study; and an indepth story on the PROPHET system. These stories appeared in such publications aa ILAR News, LAB Animal, Chemical Week, Laboratory Animal Primate Newsletter, BioScience, News & Features from NIH, the NIH Record, Public Health Reports, Medical Tribune, and others.

The Office assisted in the production of the 1979 Health Career Guidebook, produced by the Division of Associated Health Professions, DHEW. Glossy photos

of young scientists in various settings were provided to the editors. The published guidebook, sponsored jointly by the Department of Labor and DHEW, contains 11 photos with full DRR credit lines.

During the year, OSHR handled the production of the following publications:

"Sequences of Immunoglobulin Chains"
"PROPHET Molecules: A User's Guide to the Molecule Facilities of the PROPHET System"
"PROPHET Statistics: A User's Guide to Statistical Analysis on PROPHET System"
"Cost Analysis and Rate Setting Manual for Animal Resource Facilities"
"National Survey of Laboratory Animal Facilities and Resources"

In addition, the Office received and processed approximately 20 Freedom of Information requests. Approximately 200 hours of clerical and professional time was spent handling these requests.

The Privacy Act requests, all for copies of summary statements before Council, continued to rise. The Office received and processed approximately 111 requests during the fiscal year. This represents about 450 hours of clerical and professional time.

A total of 26,026 publications were distributed through the Office during the year. The Office received 14,835 individual mail requests; 385 individual telephone requests, including Congressional; and 85 individual walk-in requests. Other distribution was made by bulk mail requests, DRR display boards, and at the NIH Visitors Center.

REPORT OF THE DEPUTY DIRECTOR

Dr. James F. O'Donnell

II. Program Reports

Report of the Deputy Director

The major activities of the Deputy Director during Fiscal Year 1980 continued to be the supervision of the Review System and the Program Management System.

Within the Review System, all vacancies on the National Advisory Research Resources Council were filled by the Secretary and the new members were provided with a day of orientation prior to serving at their first meeting. Limitations on our travel budget precluded our ability to have Council members attend selected project site visits as observers to gain an understanding of resources with which they may have little familiarization. Hopefully, we will have greater flexibility in the coming fiscal year to enable us to carry out this valuable activity. Currently, we plan to hold the October 1980 Council meeting in Atlanta, Georgia, where we will have the opportunity to visit several DRR-funded resources at Emory University and Atlanta University.

A new position of Assistant Director for Review was filled this year in response to a long-standing need for full-time supervision of the DRR Review System and to effect a further separation of program from review functions.

Under study this past year have been a series of options related to the review of the Biotechnology Resources Program grant applications. Both the Program staff and the Council have been concerned for the past several years over the lack of uniformity in review of these applications, the majority of which have been reviewed by ad hoc review groups. Beginning this fall, the Division of Research Grants will assign one Executive Secretary this review responsibility. We will be evaluating over several cycles whether this will result in improved scientific merit review.

Significant program activities occurred during this year, especially related to forward planning as a result of the intensive activities related to the preparation of the DRR Five-Year Plan. The Program Directors scheduled planning sessions throughout the year with members of their Initial Review Committees and Council Program Work Groups.

The specific Program-related reports follow:

Animal Resources Program

INTRODUCTION

The overall objective of the Animal Resources Program is to support resource projects that provide, or enable scientists to use effectively, animals in human health related research. Special attention is given to those animal resource activities that are broadly supportive of the missions of the various NIH components. The objectives are accomplished through the Primate Research Centers Program and the Laboratory Animal Sciences Program.

PRIMATE RESEARCH CENTERS PROGRAM

The seven Regional Primate Research Centers (RPRC's) were established with NIH funds during the period of 1961-1965. The Centers and their respective locations are: University of Washington RPRC, Seattle, Washington; Oregon RPRC, Beaverton, Oregon; California RPRC, Davis, California; Delta RPRC, Covington, Louisiana; Yerkes RPRC, Atlanta, Georgia; New England RPRC, Southborough, Massachusetts; and Wisconsin RPRC, Madison, Wisconsin. Each Center is affiliated with a host academic institution. The Centers have unique resources and research environments which are suitable for a broad range of biomedical research. The Animal Resources Program provides core operational support for the Centers through resource grants. Research projects at the Centers are funded largely by NIH categorical Institutes, other Federal agencies and private foundations through grants and contracts which are held by core staff and collaborative/affiliated scientists. Through their use of nonhuman primate models, these scientists have made numerous important contributions to biomedical research. During the past year, investigations have been carried out in various biomedical areas, including reproductive biology, infectious diseases, behavioral sciences, neurosciences, toxicology, nutritional and metabolic diseases and environmental health.

Core support in the amount of $16.131 million provided by this Program in fiscal year 1980 enabled the 138 core staff doctoral-level scientists to conduct research in the Centers. In addition, the resources and services of the Centers were made available to 615 affiliated, collaborative and visiting scientists from various academic institutions. Research training environments were provided for 232 graduate students engaged in thesis related research. The Program provided salary support for 654 doctoral level, technical, and administrative staff personnel.

On a regional basis, the Centers provided a total of over 7,000 biological specimens to 292 scientists at various research institutions throughout the United States. Scientific productivity within the seven Centers has remained strong during the past year, with over 600 journal articles and books published by the core staff and affiliated/collaborative scientists.

Restricted supplies of certain species of feral nonhuman primates (e.g., rhesus monkeys) available from their countries of origin have continued to pose significant and costly problems for the Centers. The domestic breeding programs of the seven Centers produced approximately 1,900 infants and fetuses during the past year, representing nearly 70 percent of their total

primate requirements. Small nuclear colonies of a number of less commonly used primate species have been maintained to assure the survival of these species for potential research needs in the future. A total of approximately 12,000 primate animals (45 species and subspecies) were maintained by the Centers during the past year for research and domestic breeding uses.

The major research themes of each Center and selected examples of their research activities during the past year are as follows:

WASHINGTON REGIONAL PRIMATE RESEARCH CENTER, UNIVERSITY OF WASHINGTON AT SEATTLE

The basic research program of the Washington RPRC covers the areas of neurological sciences, cardiovascular function, developmental biology, disease models, endocrinology and metabolism, and craniofacial structure and function. An extensive collaborative program involved over 60 scientists engaged in a variety of investigative areas. An example of research activities at this center is given below.

Link Between Insulin Levels in the Brain and Development of Obesity

It was postulated that body fat, normally maintained within rigid limits, is regulated by some signal which informs brain centers controlling food intake about the present state of body fat. The identity of the signal is unknown, but insulin is a possible candidate. Obese humans have higher levels of insulin in their cerebrospinal fluid than lean humans, and the insulin level for both groups is reduced after a prolonged fast. Scientists at the University of Washington RPRC postulated that the feedback system responding to body fat uses the concentration of insulin in the cerebrospinal fluid as a major signal. To test the hypothesis, they developed a Papio cynocephalus (baboon) model in which feeding was monitored and in which experimental access to blood and cerebrospinal fluid was maintained. The data from these studies showed that the infusion of insulin into the cerebrospinal fluid leads to a reliable and predictable decrease in food intake and reduction in body weight. Insulin appears to be signal which tells the body how fat it is.

The investigators believe that their research may eventually help explain the problem of obesity in humans. Among some obese persons, the brain may not sense the increased insulin levels or other signals in the brain may override the signal from insulin to eat less. However, it is impractical and unwise to administer insulin directly to obese persons. If that were done, it would lower the individual's blood sugar level, creating a desire for food. Thus, the metabolic glucose signal would be, "Eat more," while the insulin signal to the brain would be, "Eat less." The results would be unpredictable. Additional research may be directed to producing a synthetic hormone similar to insulin with an effect only on the brain and not on the metabolic system.

OREGON REGIONAL PRIMATE RESEARCH CENTER, UNIVERSITY OF OREGON HEALTH SCIENCES CENTER

Major areas of research emphasis at the Oregon RPRC have continued to include reproductive biology, perinatal physiology, cardiovascular pathology,

cutaneous biology, immunology, nutrition, toxicology, and metabolic diseases and behavior. An example of activities during the past year is as follows:

Polychlorinated Biphenyls, Dibenzo-p-Dioxins, and Dibenzofurans

Polychlorianted biphenyls, dibenzo-p-dioxins and dibenzofurans, the man-made chemicals now found in the general as well as in industrial environments, are highly toxic for mammals. However, species differ greatly with respect to sensitivity and pathologic response. Rhesus monkeys were found to be among the most susceptible animals; following exposure to these agents, they develop changes in the skin that closely resemble chloracne, a human skin disorder considered a hallmark of accidental human poisoning. Lesions that developed on the epidermis, stomach, and thymus of rhesus monkeys after acute or chronic exposure were indistinguishable for the three kinds of compounds. These lesions do not represent cell damage, but alterations in the growth and differentiation of certain specialized epithelial structures. Rhesus monkey fetus is particularly susceptible and small doses of tetrachlorodioxin or biphenyl given early in pregnancy are followed by a high rate of abortion.

The single known biochemical action of these agents is a powerful stimulation of liver oxidative enzyme systems. The exact pattern of this induction is dependent on the molecular location of the chlorine atoms in the offending chemical. The compounds are stable and persistent in the environment. They are a potential threat to human health not only because they are themselves noxious but also because they may synergize with other unrelated toxic chemicals through the mechanism of enzyme induction.

CALIFORNIA REGIONAL PRIMATE RESEARCH CENTER, UNIVERSITY OF CALIFORNIA AT DAVIS

The major research emphasis of the California RPRC relates to environmental health sciences and infectious diseases. Other areas under investigation include perinatal biology, behavioral biology, respiratory physiology and immunology. An example of research activities during the past year is as follows:

Effects of Oral Contraceptives During Early Pregnancy

Investigators in the Perinatal Biology and Reproduction Unit have evaluated the effects of inadvertent consumption of oral contraceptives during early pregnancy in rhesus monkeys. Several retrospective studies in humans have suggested that there is a correlation between sex steroid exposure during early pregnancy and anatomic/behavioral abnormalities in offspring. Norlestrin, an oral contraceptive, was administered to the rhesus monkeys at levels equivalent to two, four and 10 times the recommended human dosage at various periods during early pregnancy. Sixty-three percent of the treated pregnancies produced offspring with no indications of birth defects while 37.7 percent resulted in abortion or stillbirth. The latter level is significantly higher than the spontaneous rate of fetal death in untreated pregnancies. The results of this study indicated that administration of an oral contraceptive to rhesus monkeys during early pregnancy causes an increased level of early fetal death but is not related to a higher incidence of birth defects as previously suggested in humans.

DELTA REGIONAL PRIMATE RESEARCH CENTER, TULANE UNIVERSITY

The Delta RPRC core research programs cover the areas of infectious diseases (a major focus) as well as the areas of immunology, parasitology, biochemistry, neurobiology, and urology. The affiliate/collaborative program includes other areas such as vision research. An example of the research projects underway at the Delta RPRC is given below.

Cornea Attachments for Correction of Visual Defects

This project relates to the development of surgical techniques to correct vision defects by using corneas taken from dead animals. Corneas were surgically removed from donor primate animals, frozen, and shaped on a lathe to certain specifications. While the freezing and thawing procedures did destroy most of the cells, the network of tissue residue that remained was surgically attached to the eye of the recipient primate animal. This nonliving network of tissue was quickly invaded by cells from the cornea of the recipient animal, thus resulting in the desired change in the curvature of the eye. The net effect of this new technique was correction of the vision defect using a living contact lens. These encouraging laboratory results are believed to have great potential for future application to human patients.

YERKES REGIONAL PRIMATE RESEARCH CENTER, EMORY UNIVERSITY

Research at the Yerkes RPRC includes psychobiology of great apes and monkeys, anatomical and physiological aspects of the central nervous system, muscle pathology, reproductive biology, immunology, and language acquisition. An example of their activities during the past year is as follows:

Language Studies

The chimpanzee was used as a behavioral animal model for studies of the requisites to communication skills. The results emerging from this study are related to a companion project with mentally retarded children. Results to date support the conclusion that methods which facilitate learning by chimpanzees are particularly effective in facilitating the learning of severely retarded children. The research with chimpanzees has clearly demonstrated that they are able to use symbols referentially, symbolically, and communicatively, just as humans use words. Two chimpanzees, Sherman and Austin, use their words to request foods and tools of one another, contingent upon tasks to be solved. They have also learned the names for several locations, which will be incorporated into future research. The development of electronic systems and computer systems to facilitate language acquisition by chimpanzees and children is also being pursued.

NEW ENGLAND REGIONAL PRIMATE RESEARCH CENTER, HARVARD UNIVERSITY

The New England Center's core research program covers the areas of infectious diseases, psychobiology, pathobiology, viral oncology, and diseases of primates. The Center's extensive collaborative research program includes numerous other biomedical areas of investigation. An example of research

conducted in the core program at the New England RPRC during the past year is as follows:

Behavioral Effects of Drugs

The use of nonhuman primates in research on the behavioral effects of drugs has provided important information that simply could not be obtained from research using human subjects. Pharmacological and environmental determinants of a drug's effects, which would remain uninvestigated in humans, can be easily studied in animals. Especially relevant examples are those studies in which: (1) behavior is controlled by noxious events; (2) chronic drug regimens are employed; (3) the drug being investigated has a high potential for abuse or may produce physical dependence; or (4) behavior has been produced, through appropriate manipulations of environmental histories, that may be considered "abnormal" or maladaptive. Various drugs that have previously been shown to cause neurochemical changes that develop slowly with chronic administration are being studied for their behavioral effects. Since most drugs used clinically to modify behavior are administered chronically, it is important to study their behavioral effects over extended time periods.

Drug dependence is characterized by drug-seeking and drug-taking behaviors that are highly detrimental to the drug-dependent individual and to society. Experimental techniques have been developed so that drug-seeking behavior can be analyzed functionally in the same way as other schedule-controlled operant behavior. Schedule processes are relevant to considerations of drug dependence because behavior developed through such processes can become so powerfully controlled that it preempts other activities and is responsible for continued exposure to the direct effects of drugs. The application of these techniques in current studies should clarify the behavioral and pharmacological conditions that determine the suitability of different drugs as reinforcers. For example, drugs will be compared with respect to the range of different conditions under which they can function as reinforcers. Comparisons of behavior controlled by drug injections and other consequent events will further indicate whether the behavioral processes involved in drug dependence are also operating in various situations not involving drugs. Thus, experimental studies of the behavioral pharmacology of drugs that can function as reinforcers are pertinent to an understanding of drug abuse.

This research has direct human health implications for prevention of drug abuse and treatment of drug dependence. Studies of conditions under which drug-seeking behavior can be enhanced or suppressed by experimental interventions or drug pretreatments will be particularly relevant. Such basic information will be valuable in the design of rational programs to treat drug addiction by behavioral or pharmacological means.

WISCONSIN REGIONAL PRIMATE RESEARCH CENTER, UNIVERSITY OF WISCONSIN AT MADISON

Focused areas of research at the Wisconsin RPRC include endocrinology, behavior, neuroscience, reproduction, and pathology of environmental pollutants. An example of research performed during the past year is as follows:

Studies on Ovarian Function

Puberty is recognized as the developmental stage between sexual immaturity and maturation and has certain striking characteristics which are similar in the human and the rhesus female. After menarchy (the first sign of puberty onset), menstruation occurs very irregularly. In addition, the early pubertal ovary usually fails to accomplish the maturation and release of eggs during the interval between successive menstruations. This period with menstruation, but without ovulation, has been called the period of adolescent sterility and it can last for months or even years. Its regular occurrence as a stage of female development has long fascinated reproductive biologists as a natural mode for fertility control, but an understanding of the mechanisms of this physiological state is poorly developed. Using the rhesus monkey as a model, scientists at the Wisconsin RPRC have uncovered a physiological event that reliably and consistently predicts or signals the time in development when the ovary can release its first egg. Unexpectedly, this essential precondition for ovulation has been shown to be a change in the activity in the brain. The basic phenomenon at puberty can be described as follows:

At a definite time in development, the brain of each individual begins to release large quantities of a chemical that regulates the pituitary ovulating hormone, which is essential for egg development and release. Moreover, the brain releases this chemical substance in a rhythmical manner with much more being released at night than during the day, and this rhythmical pattern is highly efficient in stimulating pituitary ovulating hormone. Special experimental tests have shown that ovulation can occur only after the brain has established its rhythmical release of this important chemical. The brain does not continue its day/night rhythmical release of the chemical throughout adult life. It only does so in rhesus monkeys for a limited period of 10 to 20 months, after which it reverts back to an arhythmical mode of activity. The scientists believe that the brain maintains rhythmical activity as long as necessary to produce maturation of the ovarian system, but the mechanism by which the brain knows when the system has matured is not yet understood.

OTHER PRIMATE RESOURCES

In addition to the Primate Research Centers, the Animal Resources Program supports other primate resource activities. These are as follows:

CARIBBEAN PRIMATE CENTER

This primate resource includes a basic primate colony on the Puerto Rico mainland and semi-free ranging primate colonies on islands off the coast of Puerto Rico. The Center is a valuable resource for research on primate social behavior and tropical disease research. They are currently testing a Dengue type 2/S-1 vaccine and tetanus vaccine in rhesus monkeys. The Center is also an important breeding center for the National Institute of Neurological and Communicative Disorders and Stroke.

PRIMATE SUPPLY

The Animal Resources Program has six contracts and five grants for the domestic breeding of nonhuman primates. In addition, there is a grant for a

Primate Supply Information Clearinghouse. These projects are part of the effort to provide a supply of primates for essential biomedical research in the face of export restrictions and embargoes by the countries of origin. During fiscal year 1980, no wild-caught rhesus monkeys were imported for biomedical research. The supply of other wild-caught Old World as well as New World primates continues to decline due to these increasing export restrictions. The contracts are for the production of animals for general distribution to the NIH extramural investigators. The overall goal of these projects is to provide 1,200 rhesus monkeys, 150 cynomolgus monkeys, and 400 squirrel monkeys per year. As of June 30, we have 1,653 female rhesus, 150 cynomolgus, and 138 squirrel monkeys in production colonies. There were 1,198 rhesus, 91 cynomolgus and 22 squirrel monkeys born this past year. The polio vaccine testing program took the first 250 male rhesus offspring. All females were kept for colony expansion. We supplied 205 rhesus monkeys to NIH grantees from cull, exchange, and recycled animals and have 82 young males to be weaned in the next few months. We have supplied 113 cynomolgus monkeys (adults and young) and 5 squirrel monkeys to investigators. Because of the general difficulties in maintaining optimum squirrel monkey production in captive colonies, grant applications were requested to study the reproductive problems of squirrel monkeys. One grant has been funded and the Government-owned squirrel monkeys maintained on contract will be moved to the grantee institution in the near future. The squirrel monkey contracts will be phased out.

The grant-supported primate breeding projects are for establishing nuclear production colonies and determining proper husbandry techniques for maintaining these colonies. Colonies under development are baboons, two species of marmosets, and owl monkeys.

The Primate Supply Information Clearinghouse is designed to facilitate maximum research utilization of primates already in this country. The Clearinghouse matches requests for primates, primate tissues, and related services with investigators and breeding colonies who have these items available. The Clearinghouse publishes a weekly bulletin and has placed 2,783 primates in the past year. They also published 51 formal requests in their bulletin for cadavers, tissues, and other specimens and handled many more such requests informally by telephone.

LABORATORY ANIMAL SCIENCES PROGRAM

The Laboratory Animal Sciences Program (LASP) assists institutions in developing and improving animal resources for biomedical research and training through the award of research and resource grants and contracts. Program areas include support for research related to improving health care and determining environmental requirements of animals used in research; animal colonies of unusual and and special value for research; studies directed at finding animal models which are needed for research on human diseases; projects to assist institutions to comply with the legal and policy requirements for care of laboratory animals; laboratories for the diagnosis and control of diseases of laboratory animals; and research training of specialists in the field of laboratory animal medicine. The Program awarded funds totaling $7.119 million in fiscal year 1980, which supported 64 discrete animal research and resource projects, eight institutional training programs, and one individual fellowship award.

RESOURCE RELATED RESEARCH

Projects falling into this category generally have one of the following objectives: (1) to investigate the etiology, pathogenesis and control of laboratory animal disease problems or (2) to determine environmental requirements of laboratory animals. For example, currently active projects include the diagnosis and control of mammalian encephalitozoonosis, developing diagnostic/control methods for canine brucellosis, and control of respiratory mycoplasmosis in rodents. The encephalitozoonosis project has resulted in development of a simple, rapid test for detection of serum antibodies in rabbits. Surveys of rabbit populations have reported infection rates of 20-90%, thus demonstrating the potential for complicating research. Ongoing studies are evaluating chemoprophylaxis and continuing to clarify the pathogenesis of the disease and the immunologic impact of infection on the host. In addition to disease related studies, two ongoing projects are focused on population studies of nonhuman primates in countries of origin. These include census studies of rhesus monkeys in northern India and important habitat features relative to West African rain forest primates. The former (India) project was begun in 1959 (supported by ARB since 1973) and has provided data regarding population dynamics, demographic, and reproductive parameters of a natural rhesus population. Within the study population declines of 71% (up to 1977) were noted in an unprotected cohort while a semi-protected cohort increased 186% in the same period. Ongoing studies will provide data on the effects of the current export ban of rhesus monkeys from India, habitat displacement which is occurring with one study group, and the feasibility of intentional transplants and relocation of breeding groups. Such information is necessary as a guide to conservation and management of rhesus monkeys and will be important in evaluating the potential supply of rhesus monkeys for biomedical research.

The number of resource related projects has been relatively level in recent years (9-11 active projects). There is a growing recognition that naturally occurring laboratory animal diseases and environmental factors can have a significant effect on research projects. Clearly, there are many deficiencies in the current state of knowledge relative to many diseases, their recognition, control, etc. In recognition of this need, the support of research projects dealing with important laboratory animal disease problems was selected for emphasis in the recently prepared Five Year Plan. This year three new projects were awarded. The new projects include a study of experimentally induced mucoid enteritis in rabbits (an often fatal disease of undefined etiology) and the pathogenesis of parvovirus infection in canines (a recently recognized, often fatal disease which can pose a threat to breeding colonies and closed colonies of research dogs as well as pet animals).

ANIMAL MODELS AND SPECIAL COLONIES

The major objectives of this program area are: (1) to define, characterize and exploit the relevant biological attributes of selected animals which display potential for use in several areas of biomedical research and (2) to establish, improve or expand special colonies of well characterized animals which are of proven value for biomedical research, but which are not generally available from other sources. Projects aimed at the first

objective are of two general types. The first is represented by 3 active resources (Washington State University, the University of Alabama at Birmingham, and Michigan State University) which involve a multidisciplinary effort to identify, characterize, and make available new animal models of human genetic diseases. Input regarding potential models is sought from a variety of sources, including animal clinics, veterinary practitioners, and breeding associations and clubs. The oldest resource of this type is at Washington State University. This group has worked with 30 animal models or potential animal models during the past three years including 7 new ones recognized during this period. Some are now well established and have separate grant support including Ehler-Danlos syndrome of dogs, mink and cats (autosomal dominant disease with defective collagen formation), combined immunodeficiency disorders in horses, and juvenile type diabetes mellitus in dogs. Other models are still in the early stages of development such as mucolipidosis in cats, inherited feline tremors, and inherited canine hyperreninism. The general approach is to establish colonies of affected animals and begin characterization studies, often in collaboration with experts at other institutions who are interested in a specific model. Animals and materials from the various models are made available to interested investigators. Ultimately, some models may be transferred to other groups with the interest and expertise to carry on further studies. Other animal model projects are oriented around selected species which have potential utility as models in more than one categorical area of research. Several marine invertebrate projects, in particular, exemplify this approach. Declining natural populations and problems of maintaining species such as the sea hare, Aplysia californica, sea urchins, Strongytocentrotus purpuratus, and loliginid squids have limited research utilization in the past. Development of mariculture and maintenance techniques could favor laboratory breeding over procurement from the ocean and lead to a continuous source of species wherever they were required. Considerable success has been achieved in maintaining adults of these marine species under laboratory conditions, but much work remains to be done before year-round availability of laboratory reared stocks can be assured.

Special colony projects combine in varying degrees the maintenance and production of special strains or stocks of animals with ongoing research to further development and characterization of the models. Currently supported projects include a hamster resource at the University of Texas, Dallas; a congenic mouse resource at Sloan-Kettering Institute; a rabbit inbred and mutant stock resource at the Jackson Laboratory; and a mouse mutant gene resource also at the Jackson Laboratory. The latter project is typical of this group. The original mouse colony included some 140 mutants with a focus on endocrine, neurological and immunologic problems. The specific aims are to maintain these well defined stocks, including the long term preservation of frozen embryos and to make material available to the scientific community (approximately 1,000 animals per year are distributed to other laboratories either as breeding stock or experimental animals). A charge is made for this service and the funds are returned to the grant. In addition, the resource is interested in adding new mutants to the colony and providing initial characterization and linkage testing. In the case of this resource, the primary source of animals with aberrant phenotypes is the main breeding colony at the Jackson Laboratory which raises over two million mice a year. As an example of this activity last year, a total of 465 phenodeviants were

received by the resource and 73 were considered to be of potential scientific interest and kept for further study. Forty-four of these were not recovered in future generations, 10 were discarded and 19 are still being investigated. One example is believed to be the first Y-chromosome mutation found in mammals. This mutation in the mouse mimics one type of abnormal human sexual development; i.e., the occurrence of chromosomally male individuals that develop as females. The study of this Y^h mutation will further our understanding of the role the Y chromosome plays in sexual differentiation. A second new mutation is an autosomal recessive named "twitcher." Abnormal deposits of cellular material characteristic of a lipid storage disease were noted and the enzyme galactosylceramidase was found to be missing. Thus, the twitcher mouse is an authentic model in which to study human Krabbe disease, and hopefully further studies will help find a cure for this now lethal human disease.

Support for projects related to animal model development and the establishment of special animal colonies decreased slightly from the previous year's level; i.e., FY 1979 - $2.201 million (28% of LASP budget) versus FY 1980 - $1.912 million (25% of LASP budget). A total of 24 projects received support, including one new resource grant and five ongoing contracts. The Five Year Plan provides for a continuation of animal model and special colony activities at approximately the same or a slightly reduced level. Emphasis will be given to model development and characterization as opposed to preservation and maintenance in considering new projects.

INSTITUTIONAL ANIMAL RESOURCE IMPROVEMENTS

Institutional animal resource improvement projects are awarded to help institutions upgrade their animal facilities and develop centralized programs of animal care in support of their biomedical research programs. A major objective is to enable institutions to comply with the Animal Welfare Act and DHHS policies on the care and treatment of animals. Requests of this type usually include animal cages to meet current regulations, general sanitation equipment such as cage washers, renovation of animal facilities, and addition of trained professional and technical personnel. The projects are supported for one to three years, after which time the applicant institution is expected to take over complete financial responsibility for its basic animal resource.

Institutional improvement projects have been supported since the inception of the Laboratory Animal Sciences Program. Requests of this type peaked in FY 1973 following implementation of the Animal Welfare Act of 1970 (P.L. 91-579) and the DHHS policy on animal welfare. Over the past eight years, 93 institutions have received improvement grants with awards totaling approximately $12.2 million. The following figures represent the trend during this period:

	FY 74	FY 76	FY 78	FY 80
Reviewed	19	19	21	12
Approved	12	9	13	8
New Awards	36	6	3	4
Total Active Projects	46	21	11	6
$ Awarded (in $1,000's)	3229	1289	793	783
Percentage of Budget	51%	23%	10%	10%

The above chart indicates a relative steady rate of new proposals in recent years. The largest number of program inquiries still touch on this area. The ability to fund new projects of other types and to combat inflationary costs has come largely at the expense of this program area (note steady decrease in number of active projects and $ awarded). It was possible to fund four new proposals this year, and it appears that at least this level of funding should be maintained for the next several years.

Data from the recently completed National Survey of Laboratory Animal Facilities and Resources (published March 1980; FY 1978 data) revealed the following relative to facilities and equipment:

- Approximately 16 percent of all nonprofit biomedical research organizations reported a need for replacement of some animal facility space now in use, 38 percent reported a need for remodeling to protect the integrity of space now in use, and 43 percent reported a current need for additional space.

- Approximately $350 million is required to meet current needs of nonprofit biomedical research organizations for space replacement, remodeling, and additions. Another $407 million (using FY 1978 estimated construction costs) will be required to meet space needs projected for FY 1988.

- Nonprofit biomedical research organizations reported a current need of $43 million for equipment renovation, replacement or additions.

The survey indicates in particular a need for biohazard containment space and equipment, which reflects changes in research activities and increased recognition of the need to contain hazardous agents. In order to meet needs of the scale indicated by the survey, legislative authority (new construction and major renovation) and substantial funding over a period of years would be required. This will require careful assessment from the perspective of the NIH at large and may well not be feasible in the immediate future.

RESOURCE LABORATORIES

The objectives of these laboratories are to provide for improved animal health programs through investigation of naturally occurring disease and related laboratory animal problems, to support studies resulting in new information on diseases of laboratory animals and their etiology, to aid in the elucidation of new laboratory animal models of human disease, and to develop resources including tissues, slides, photographs, etc., for research and training. Resource laboratories have been a major program activity for over 10 years. There has been a continuing turnover in the institutions receiving such awards (support has been terminated for 13 laboratories). The total number has remained relatively constant (13-16) in recent years and approximately 28% of the budget is awarded in this area. Since resources and trained personnel are limited, laboratories have been confined to those settings with at least several million dollars of NIH-supported research

involving the use of laboratory animals. Most resource laboratories are institutional in nature; however, in several instances it has been feasible to serve more than one institution in a metropolitan or regional area. There are sixteen programs which are currently being supported. One new laboratory was funded during FY 1980.

Laboratory activities encompass a broad spectrum ranging from surveillance and monitoring to conduct of research on important laboratory animal disease problems. The laboratories have been productive in terms of new information and techniques. It is apparent that a multidisciplinary approach to disease problems is necessary in order to identify and isolate etiologic agents and then take appropriate steps to eliminate or control the problem. The interaction of clinicians, virologists, and pathologists was well illustrated by one resource when presented with the problem of shortened survival time in mice inoculated with Sarcoma 180. Focal liver necrosis was noted at necropsy, along with lesions due to the transplanted tumor. Microbiological tests were negative. Subsequent study of pooled tumor cells inoculated into suckling and adult mice and tissues culture plus fluorescent antibody tests confirmed the presence of LCM virus. An aggressive quarantine was established, and mice carrying known or suspected infected tumor lines were killed. In a follow-up epidemiologic investigation, it became apparent that other laboratories were having unexplained variances from anticipated results when using certain tumor cell lines, and LCM virus was ultimately isolated from five laboratories and 15 tumor lines. Forty-five persons were serologically tested and one was positive. The timely recognition and control of this problem eliminated the risk of human exposure as well as the publication of data from animals compromised by a latent viral infection. Another resource laboratory became heavily involved in the recent outbreak of ectromelia that appears to have originated in mice at the Clinical Center on the NIH campus. The resource was contacted when a serious disease outbreak occurred among 30,000 mice at the University of Utah Medical Center in Salt Lake City. The clinical signs consisted of swelling of the face and head, conjunctivitis, and acute death--often within 3-6 hours. Some survivors had severe skin lesions including loss of feet and tails. The disease was confirmed as being ectromelia by serologic tests, characteristic lesions, electron microscopy, and clinical signs. The resource was involved in reviewing decontamination procedures, vaccination and formulating recommendations for general management and renovation of the facilities. Approximately 10,000 mice were killed and an additional 20,000 were vaccinated. The disease achieved a substantial foothold at this institution, but two-thirds to three-fourths of the animals were saved by the prompt diagnosis and control measures. In this outbreak, the loss in animals alone was estimated at $600,000; but lost time on the part of investigators, decontamination, etc., would magnify this figure several times. Thus, the potential impact is apparent if the disease had not been localized and controlled before spread to other animal facilities in this country or abroad.

Recognition of potential animal models is an important aspect of working up problems presented to the laboratory. One laboratory recently reported the occurrence of diabetes mellitus in degus (Octodon degu). Inclusion bodies were demonstrated in islet, acinar, and ductual cells of the pancreas from some of the degus with clinical signs of diabetes. Electron microscopy revealed many spherical DNA virus-like particles similar in size and shape to

cytomegalovirus particles in man and other animals. The presence of insulitis, characteristic inclusions of cytomegalovirus in the pancreas and clinical evidence of islet dysfunction suggested viral infection as the cause of diabetes in these animals. Studies are underway to isolate the virus in cell culture and further define its relationship to diabetes. This model offers considerable promise in helping understand the possible relationship between cytomegalovirus and islet cell function in man since there are a number of reports of generalized cytomegalovirus infection in infants and signs of infection in several organs, including the pancreas. Solution of individual clinical problems can also be important when dealing with valuable laboratory animals such as nonhuman primates. Intermittent diarrhea and chronic weight loss over a two year period was noted in a female adult stumptail macaque when fed a commercial laboratory maintenance diet. Extensive laboratory workup plus a favorable clinical response to dietary substitution resulted in a diagnosis of lactose intolerance. As added findings, it was noted that Ketamine HCl used to restrain unconditioned macaques during lactose intolerance tests adversely affected the establishment of baseline plasma glucose tolerance curves. Thus, repetition of the tests after chair-conditioning the animals to produce clear baseline control data against which the lactose intolerant animal could be compared was necessary. This is the first report of clinical disease associated with lactose intolerance in this species.

REFERENCE CENTERS AND INFORMATION PROJECTS

The Program supports several reference center and information projects. These include the Simian Virus Reference Laboratory at the Southwest Foundation for Research and Education, San Antonio, Texas (diagnostic virology, serology and consultation service); a Blood Group Reference Laboratory at New York University School of Medicine (nonhuman primate blood typing); an Animal Model Reference Center at Texas A&M University, College Station (sperm bank for animal models); and publication of the Laboratory Primate Newsletter. The range of activities encompassed by projects of this type is reflected by the following examples:

1. The Registry of Comparative Pathology, located at the Armed Forces Institute of Pathology. The Registry has continued to augment its collection of specimens from primates and other laboratory animals, domestic and wild animals, fish and birds (over 1,600 accessions during the last reporting period). Material has been made available to others and utilized for the preparation of exhibits, lantern and microscopic slide sets and as the basis for a number of publications. In addition to responding to numerous outside requests for consultation, the Registry publishes a quarterly Comparative Pathology Bulletin to promote communication and information dissemination to the biomedical community (over 3,100 names on present mailing list). Since 1972 it has been responsible for preparation of one or two descriptions of an animal model of human disease for publication each month in the American Jounal of Pathology. A handbook entitled "Animal Models of Human Disease" has been prepared for sale. Eight fascicles covering 180 models plus a cumulative index have been published so far. An annual short course (3 days) in comparative pathology was offered for the seventh time in May 1980. Also, this year a workshop entitled "Needs for New Animal Models of Human Disease"

was held in April at NIH. The proceedings of this workshop will be published as a supplement to the American Journal of Pathology.

2. An Immunohematological Reference Center located at Michigan State University. This reference center was established to produce, standardize, and unify the resources available that recognize red blood cell groups, histocompatibility antigens, and other immunogenetic markers in the dog. The canine erythrocyte blood group system has been operational for a number of years. Efforts in the past year focused on reagent production for histocompatibility antigens. Collaboration with other investigators by providing reagents and typing services has increased and has been a major commitment of the Center. During the last reporting period, a total of 264 animals were typed for erythrocyte antigens, 279 were characterized for histocompatibility antigens, and 382 ml. of various typing sera were provided to qualified investigators.

TRAINING

Training in laboratory animal medicine is intended to prepare individual to provide professional care of the many species of laboratory animals, to manage central animal resources, and to give special assistance to investigators through knowledge of laboratory animal biology and understanding of research methods. In addition, the trainees are prepared to participate in the teaching of graduate students and young investigators and to pursue their own research interests either as independent investigators or as a member of a research team.

There are eight currently active training programs with a total of 29 funded trainee positions. In addition to the institutional programs, one individual postdoctoral fellowship was active at the end of the fiscal year. Since the average training period is two and one-half years, there are usually 8-10 graduates per year. Currently available figures indicate that 154 trainees and fellows have completed training since the inception of training grants and fellowships in laboratory animal science and medicine. Fifty (50) of these are employed by medical schools and 60 by other academic, research or governmental organizations. The majority (89) are serving as directors or staff members of a vivarium; 52 are engaged in research or obtaining additional training; and 13 are in public health, private practice or are retired. Retention in the field of laboratory animal medicine has been excellent, emphasizing the career orientation provided by the training and the continuing need and opportunities available for such individuals.

For the past five years, the active training programs and diagnostic resources have been encouraged to employ veterinary students during their summer break. Seven programs and 13 students participated this past year. Critiques of the students involved were submitted to the Branch and, in turn, distributed to all the program directors. It appears that this work experience is resulting in greater knowledge and interest in the field of laboratory animal medicine by veterinary students. Several former summer students entered formal postdoctoral programs this year and development of a "pool" of such individuals for future postdoctoral training should result in long-term benefits to the field.

Table I

Primate Research Centers Program Applications - FY 1980

Type	Number Rec'd	Amount Requested[1/]	Number Appr	Amount Approved[1/]	Number Funded	Amount Funded[2/]
New.....	-	--	-	--	-	--
Renewal.....	1	2,801,125	1	2,614,256	1	14,001,517
Supplemental	-	--	-	--	-	--
Continuation	6	15,711,124	6	14,828,800	6	2,129,603
TOTALS	7	18,512,249	7	17,443,056	7	16,131,120

Table II

Laboratory Animal Science Program Applications - FY 1980

Type	Number Rec'd	Amount Requested[1/]	Number Appr	Amount Approved[1/]	Number Funded	Amount Funded[2/]
New.....	40	4,588,962	34	3,118,881	11	1,244,295
Renewal.....	18	2,602,340	17	1,915,201	9	1,416,102
Supplemental	11	250,223	11	188,592	10	149,046
Continuation	36	3,211,810	36	2,571,627	34	3,666,367
TOTALS	105	10,653,335	98	7,794,301	64	6,475,810

Table III

Laboratory Animal Science Programs - FY 1980

Program	Number Rec'd	Amount Requested[1/]	Number Appr	Amount Approved[1/]	Number Funded	Amount Funded[2/]
Resource Research	24	1,495,391	24	1,223,077	11	664,881
Primate Resource.	10	1,142,043	9	936,058	4	429,042
Special Colonies and Models.....	26	2,015,526	25	1,655,532	19	1,705,529
Basic Improvement	14	2,300,185	10	1,169,143	6	783,004
Diagnostic Labs..	21	2,952,317	21	2,210,392	16	2,203,829
Reference.....	5	634,666	5	492,167	4	550,047
Info. & Other....	4	88,207	3	82,932	3	100,797
Research Career..	1	25,000	1	25,000	1	38,681
TOTALS	105	10,653,335	98	7,794,301	64	6,475,810

1/ Direct Costs Only
2/ Includes Indirect Costs

Table IV

Contract Program - FY 1980

Program	Number Supported	Amount Funded
Special Colonies and Models	5	206,021
Primate Resources.....	1	150,000
Primate Supply.....	5	804,149
Program Support.....	4	145,900
TOTALS	15	1,306,070

Table V

National Research Service Award Program - Institutional - FY 1980

Type	Number Rec'd	Amount Requested 1/	Number Appr	Amount Approved 1/	Number Funded	Amount Funded 2/
New.....	-	--	-	--	-	--
Renewal.....	2	233,840	2	282,560	2	113,684
Supplemental	-	--	-	--	-	--
Continuation	6	460,017	6	460,017	6	507,909
TOTALS	8	693,857	8	742,577	8	621,593

1/ Direct Costs Only 2/ Includes Indirect Costs

Table VI

National Research Service Award Program - Individual - FY 1980

Type	Number Received	Number Approved	Number Funded	Amount Funded
New.....	-	-	-	--
Renewal.....	-	-	-	--
Supplemental	-	-	-	--
Continuation	1	1	1	21,382
TOTALS	1	1	1	21,382

Table VII

Short Term Training Program Applications - FY 1980

Type	Number Rec'd	Amount Requested 1/	Number Appr	Amount Approved 1/	Number Funded	Amount Funded 2/
New.....	7	198,320	7	119,930	1	13,025
Renewal.....	-	--	-	--	-	--
Supplemental	-	--	-	--	-	--
Continuation	-	--	-	--	-	--
TOTALS	7	198,320	7	119,930	1	13,025

1/ Direct Costs Only 2/ Includes Indirect Costs

Biotechnology Resources Program

Background and Summary of Past Accomplishments

The Biotechnology Resources Program (BRP) was initiated in 1962 in response to a Congressional interest that NIH establish an activity focused on specialized equipment needed for biomedical research. Since that time, the BRP (formerly called Special Research Resources) has changed and expanded its scope. While the program in the early years, mainly supported large general purpose computer centers in medical schools, it later moved into an extremely broad and innovative array of biomedically relevant technologies. In addition, the program now places greater emphasis on broad-based sharing of resources. Major thrusts of the program today are applications of biomedical engineering, computer science and knowledge systems to biomedical and clinical research programs, and development of specialized instrumentation for the study of biological structure and function.

Technical capabilities provided by the BRP continue to be essential for progress in many areas of scientific investigation. Without advanced technological resources, biomedical research scientists would be unable to make important morphological and chemical measurements or to handle the vast amount of data required to reach valid scientific conclusions.

Over the years, physical and mathematical theories have been developed and subsequently used by engineers in order to responsively provide important research instrumentation necessary for solving problems in biomedical research. That interface between scientists and engineers, so essential for the scientific advancement of biomedical knowledge, is not always obvious nor easily established. Through its operation at this interface, the BRP has been able to develop and make available advanced, highly sophisticated research tools for biomedical science.

BRP has developed and made available to scientists a wide range of computer systems for study of biomedical problems. Among the more recent are computer systems for applying artificial intelligence methods to biomedical problems, computer graphics systems for study of three-dimensional structure of proteins, nucleic acids, interactions of proteins and drugs, and structure of nerve cells and fibers. The development of the first high field 600 MHz nuclear magnetic resonance spectrometer for biomedical research was supported by BRP in collaboration with NSF. BRP introduced the first million volt electron microscopes dedicated to biological research in this country and in the world and supports high resolution scanning transmission electron microscopes used in resolving single atoms in cells and tissues.

FY 1980 Accomplishments

Administrative -- New Resources

BRP funded four new resources this fiscal year. Two resources offer new specialized equipment and technology not available elsewhere on a shared basis. A Synchrotron Radiation Biotechnology Resource was established at Stanford University for use of synchrotron radiation in biomedical research

studies involving X-ray diffraction, X-ray spectroscopy and fluorescence measurements. Initial research will be on characterization of metal containing proteins using extended X-ray absorption fine structure techniques and the determination of protein crystal structures using anonolous X-ray scattering information from single crystals. The former method takes advantage of the high intensity of synchrotron X-radiation and the latter studies require tunable wavelength capability for effective use. Access to a laser microbeam instrument is now possible for scientists, with the opening of the "Laser Microbeam Biotechnology Resource" at the University of California, Irvine. It is able to perform subcellular, cellular, and tissue level microsurgery on cells in vitro or in the organism.

A Scanning Transmission Electron Microscopy Resource was established at Johns Hopkins University. The research focus will be on the localization of heavy atom stains on proteins, nucleic acids and cells. Mass spectrometry applications in pharmacology and clinical medicine will be emphasized in the "Clinical Mass Spectrometry Resource" established at the University of Colorado Medical School, Denver.

Workshops, Conferences, and Exhibits

Six conferences or workshops were held in Fiscal Year 1980. The Stanford Magnetic Resonance Resource held its fifth annual conference on molecular structural methods in biological research on November 19-20, 1979, at Stanford University. A workshop on simulation and simulation resource was held on December 16-19, 1979, at the University of Washington Continuing Education Center at Lake Wilderness. A meeting to discuss problems and opportunities in the area of scanning transmission electron microscopy was held on December 10, 1979, in Bethesda, Maryland. The capabilities of 600 MHz Nuclear Magnetic Resonance Spectrometers were discussed in a symposium held in December 1979 in Pittsburgh. On June 4-6, 1980, a Conference on Implantable Transducers and Systems: Closed-Loop Physiological Control was held at the Biomedical Electronics Resource, at Case Western Reserve University. The 6th Annual Artificial Intelligence in Medicine Workshop was held at Stanford University August 13-16, 1980, and the Annual PROPHET Users' Colloquium was held on May 15-17, 1980, at Airlie House, Warrenton, Virginia.

BRP showed an exhibit featuring the BRP Resource Directory and Program Guidelines at Federation of Associated Societies in Experimental Biology Meeting in Anaheim, California, April 13-18, 1980, and at the American Society of Biological Chemists and Biophysical Society in New Orleans, Louisiana, June 1-5, 1980.

Research Accomplishments --
Biomedical Computing

A striking development at the Computer Graphics Resource at the University of California, San Francisco, is the first demonstration of real time interactive color surface graphics. It is now possible to display and interact with 3-dimensional (3-D) computer representations which combine both skeletal structures (labeled if necessary) and surfaces of molecular models. This combination is impossible with present real space models.

The surfaces correspond to the "solvent accessible" regions of the molecule defined by interacting with an idealized water molecule. The addition of the skeleton gives a sense of stereochemical scale and allows inter-atomic distances to be clearly demonstrated. Full use is made of the power of the Evans and Sutherland Picture System II color display. The molecules can be easily distinguished by color (and/or the atoms can be color codes -- both skeletal and surface); depth cueing and real time rotation together with optional time-separated stereo, allow full 3-dimensionality. The 3-D clipping planes allow selection of appropriate section for viewing and even permit views from the inside, as well as the outside. All of this can be manipulated in real time and is being actively developed for use in drug design. A feature article on this work appeared in Chemical Engineering News, July 21, 1980.

During the past year, Drs. Earl Zimmerman, David Margulies, and William F. Marovitz of the Department of Neurology, Columbia Presbyterian Medical Center and Anatomy Department of Mt. Sinai Medical Center, have initiated a collaborative study with the staff of the Computer Graphics Resource at Columbia University on peptides and other chemical compounds which modulate neuroactivity in the central nervous system of mammals. A relational data base incorporating three dimensional (3-D) structural data and significant functions of these modulators have been assembled by these investigators. This data base called NEURONET, which uses the Resource's capability of relating 3-D structure to other data, permits a new level of clarity in the integration, storage, retrieval, and communication of basic neuroscientific findings from different laboratories.

An extensive rat brain atlas has been entered into the resource computer system at Columbia so that the whole brain or any portion of it can be studied in 3-D. The distribution of multiple peptides in a single region of brain has been studied. In particular, the relationship between the vasopressin cells of rat paraventricular nucleus and cells containing oxytocin, enkephalin, angiotensin II, neuroteinsin, and cholecystokinin, was examined. This work is being continued to create a detailed atlas of peptide distribution fields. This is of particular interest because the distribution of bioactive substances does not always adhere to the contours of nuclei or brain regions. It may well be that structure-function correlations are best sought to the contours of neuromodulator distribution fields rather than to the contours of brain nuclei. A logical extension of the work with the rat brain atlas is the creation of a three-dimensional human brain atlas by tracing serial sections of human brain (from a standard stereotactic atlas) into the computer system. With the assistance of Drs. Hawrylyshyn and Tasker (Toronto General Hospital), the Columbia resource has now created the first portions of a computer-based human atlas. It is anticipated that such an atlas will permit the development of an interface to CAT (Computerized Axial Tomography) scan output and permit a new level of information in human structure-function studies.

The project in "Pulmonary Function Test Interpretation and Ventilator Management" (PUFF/VM) at the Stanford University Medical Experimental Computer Resource (SUMEX) interprets standard laboratory measures of pulmonary function, including measured flows, lung volumes, pulmonary diffusion capacity, and pulmonary mechanics. It prepares a report for the patient record, explaining the clinical significance of measured test results and tentatively diagnosing

the presence and severity of pulmonary disease for review by a physician. The ventilator management program, VM, still in early development stages, is being designed to interpret the clinical significance of physiological data from patients in the intensive care unit. The interpretation will be used to assist in managing patients receiving ventilatory assistance by providing a summary of a patient's physiological status, recognizing unusual events in the patient-machine system, and providing suggestions for appropriate therapeutic action. The PUFF program has been transferred to a computer at Pacif Medical Center, where it has been in routine daily use for over one year. Currently it uses about 150 pulmonary physiology rules to interpret results. Over 80% of the reports are accepted by the reviewing physician without chan signed, and entered into the patient record. Most of the remaining reports require the addition of a comment about the relation between current and previous test results -- a manual step that is necessary because the PUFF system does not yet have historical test data available on the computer.

Over the past two years, the Washington University Resource for Biomedical Computing has collaborated with the American Heart Association (AHA) under contract with the National Heart, Lung, and Blood Institute, to develop a carefully documented database for the evaluation of dysrhythmias detectors. Despite the seriousness of the clinical problems addressed by dysrhythmia detectors, there has existed no agreed-upon method for evaluating the adequacy of their performance. The final database, to be released upon complet of documentation, contains 160 three-hour recordings covering eight dysrhyth classes. A panel of nationally recognized experts from four universities has selected examples from among 400 candidate recordings submitted by 17 institutions from six countries. The nature of every heartbeat in the last 30 minutes of each of the selected recordings is then designated by another panel of distinguished electrocardiographers from three universities. Logis and technical support for soliciting, screening, processing, analyzing, reviewing, and documenting the content of each 24-hour candidate recording and the final choices therefrom, is provided by the Washington University Resource. The technical capability for doing so is the direct result of sustained BRP funding of fundamental research to develop and support a high-performance computer-based ECG analysis system. Benefits of this effor will accrue to patients, medical practitioners, purchasers of monitoring or analysis systems or services, system developers, and agencies concerned with technology assessment and regulation. The tools are now in hand for perform ing the sorely needed evaluations which will foster a mechanism to assure th consumers of the integrity of the information upon which life-saving decisio are made.

A study of immunoglobulin protein and nucleic acid sequences is being conduc by by Dr. E.A. Kabat of Columbia University in New York and the NIH, in collaboration with Dr. T.T. Wu, at Northwestern University in Evanston, Illi using the PROPHET National Computer Resource. This cooperative study has resulted in extensive publication in scientific literature as well as an automatically computer typeset compendium of all known Sequences of Immunoglobulin Chains. This compilation is essential to understanding how antibod are generated and how genetic information for antibody specificity is stored in the DNA and transmitted from generation to generation.

Biomedical Engineering

Drs. Barry Dworkin and Neal M. Miller, behavioral scientists at the Rockefeller University Computer Research Resource, have developed a method to treat idiopathic scoliosis (which usually ends in lateral curvature of the spine) by employing the techniques of biofeedback. Scoliosis is usually treated by surgery or by having the patient wear a cumbersome and move restricting Milwaukee brace. The patients in this project wear a light-weight, small, battery-powered device which detects undesirable posture shifts by means of two flexible bands placed about the torso. A miniaturized electronic circuit uses digital logic to respond to these postural shifts. After a prespecified time delay, an audio oscillator is turned on at low volume so that a faint tone is heard by the patient. If the improper posture is corrected, the oscillator is turned off. However, failure to correct the postural shift within a certain time interval will result in a much louder tone being produced. At present, 16 young women are participating in a study and preliminary data is encouraging with respect to slowing down the increase in lateral curvature or arresting any further increase.

A miniature thermometer array developed in the Resource for Silicon Biomedical Transducers at Stanford University provides an essential tool to cancer researchers who are studying the reversal of tumor growth by localized heating of the tumor through application of electromagnetic waves. The array, injected into living tissue within a hypodermic needle, may be left in place for short-term or long-term measurements. It monitors temperature at several points so that tumor cells are heated to a high enough temperature and healthy tissues are not over heated. The usefulness of the thermometer array has already been demonstrated in short-term animal experiments.

An inflatable vest for measuring cardiac signals has been developed by the Biomedical Electronics Resource at Case Western University. Three sizes of vests and associated electronic circuits, that obtain surface potential signals at 180 points across the dorsal surface, have been designed, fabricated, and evaluated. The system operated by a nurse is being used routinely at Rainbow Babies and Children's Hospital to make recordings on magnetic tapes. The overall goal of the project is to correlate potentials on body surfaces with cardiac physiology and pathology in pediatric patients undergoing catherization to obtain a data base on normal and abnormal patients. It is anticipated that by using the different methods of displaying potential maps, the superior diagnostic capability of this technique over conventional cardiography can be demonstrated. The technique called body surface potential mapping for cardiac diagnosis may have great significance in determining the nature of the disease and treatment for cardiac patients, particularly children.

Biological Structure and Function

The 600 MHz NMR spectrometer at Carnegie-Mellon University was completed and evaluated during this fiscal year. The capabilities of the spectrometer were described at a symposium held at the Biotechnology Resource in Pittsburgh in December, and the instrument is now being used by a number of scientists throughout the country.

Reye's Syndrome is a potentially deadly condition which strikes children between the ages of two and 20, usually after an influenza B, German measles, or chicken pox infection. A researcher from Tufts University developed an in vitro assay of mitochondrial oxidation which correlated well with clinical stages of the disease, and has been collaborating with the MIT Mass Spectrometry Facility to identify the compound involved. After several years of work the unknown compound was isolated and found to be uric acid. This result makes it possible to use a routine clinical test (uric acid level) to assist the diagnosis and follow the course of the disease.

Recently the Stable Isotope Resource at the Los Alamos Scientific Laboratory completed a 700-foot long distillation plant for the enrichment of the stable isotope carbon-13 from its natural abundance level of 1.1 atom % to an isotop purity greater than 99 atom % by the low temperature distillation of carbon monoxide. With the addition of this latest plant, the Resource can now produce routinely all the stable isotopes of the key elements in living systems. The isotopes are incorporated into natural products and drugs for research uses, including metabolic studies for the early detection of disease pharmacokinetic and bioavailability studies of drugs and structural investiga tions of enzymes.

The Brookhaven Scanning Transmission Electron Microscope Resource has develop the capability for high accuracy mass measurement on small particles visible to the electron microscope. The technique takes advantage of the linear relationship between the electron scattering power of the specimen and its molecular weight. The Brookhaven STEM uses a cold stage to minimize mass loss during measurement, a freeze drying and vacuum transfer system to avoid drying artifacts, and a data acquisition and analysis system optimized for quantitative mass measurements. Applications have included determination of the number of subunits in the active complex of a biotin enzyme complex and a reconstituted chromosomal subunit.

Introduction

During the past year, the program has reviewed and analyzed program progress during the past ten years. Particular attention has been paid to the analysis of the General Clinical Research Centers (GCRC) Program with respect to the overall DRR mission and its relationship to the needs of the NIH. An analysis of the overall scientific merit of studies utilizing CRCs has been made. The distribution of GCRC dollars to U.S. institutions has been shown to correlate closely with the distribution of NIH funds for grants to physicians involving research with human subjects. Portions of these analyses have been presented to the NIH Research Resources Coordinating Committee and DRRs advisory committees where they have been favorably received. A paper titled Clinical Research Perspectives from the General Clinical Research Centers Program was presented to the Institute of Medicine Conference on Clinical Investigations in the 1980s: Needs and Opportunities.

During the 1970s, application of new program policies together with intensified scientific peer review has resulted in a program substantially different and improved from its counterpart of ten years ago. In 1969, there were 92 centers with 1016 beds, with a mean priority score of 251. Since 1969, 32 of these centers, with 269 beds, at a mean priority of 310, have been terminated. The remaining 60 centers, funded in 1969 with 757 beds, have been reduced to 523 beds. The space for the 234 beds eliminated from these 60 centers has been converted to space for outpatients, revenue-producing C patients, and storage. The outpatient space, including treatment rooms, waiting rooms, examining rooms, and offices, has been staffed by existing center personnel. The 20,000 C patient days per year generate about two million dollars in revenue, helping to offset the personnel cost of operating the centers. Plans call for use of some of the remaining storage space for data management resources (CLINFO) and support staff for the centers. During the ten year period since 1969, 12 new centers, with 82 beds, have been added to the program, with an average priority score of 207. Five of the 32 centers which were terminated have reappplied and competed successfully for 27 beds.

In summary, then, in 1969 the program supported 92 centers with 1016 beds, with an average priority score of 251, while in 1980 it supports 75 centers with approximately 600 research beds and 76,000 outpatient visits, with an average priority score of 213. The average length of patient stay decreased from 10.4 days in 1969 to 5.7 days in 1979.

Program Content and Quality

The program supports 80 percent of the research inpatient care for the extramural program of the NIH. More than 3000 projects are conducted on the centers each year by an even greater number of investigators, most of whom receive support from research grants, training grants, program project grants, NIH contracts, or career development awards. Except for the absence of the larger clinical trials, the program content is reflective of the NIH clinical research program as a whole. More specifically, in 1978 investigators using the centers were supported by 2100 NIH grants and contracts totaling $270,000,000 (Table I). An additional estimated $30 million was received by investigators from research foundations and societies, industry, and other sources.

Another way of looking at program content is by broad disciplinary categories (trans-NIH activities). In 1977, the centers reported 433 projects, costing $10,150,000, in nutrition; 578 projects, costing $7,242,000, in genetics; 330 projects, costing $5,962,000, in diabetes; and 91 projects, costing $1,540,000, in arthritis. Of course, some of these categories (e.g., nutrition and diabetes) are not mutually exclusive, but they do give some idea of program support in a few research areas of great public interest.

Measures of program quality are somewhat more difficult to make, since one is always confronted with the question, "Quality compared to what?" In terms of publications, the program has had a more than 50 percent increase in output since 1970 (Table II). Moreover, there has been a steady increase in publications resulting from outpatient studies. Thus, the program seems to be far more productive than it was ten years ago despite the substantial decrease in the number and size of centers supported.

A recently completed priority score study provides some information on the level of quality. At site visits, investigators using the centers are ranked on a scale, like that used by the NIH study sections, by site visit teams which are composed of national experts in the fields being reviewed and which are comparable to the NIH study sections.

In this study, the priority scores awarded to individual investigators at site visits in 1976 were compared with their utilization of patient days and outpatient resources in 1977. In 14 consecutively reviewed centers, 82 percent of the patient days were utilized by investigators whose work had been assigned priority scores at the DRR site visit; 18 percent of the patient days utilization was by new investigators. Of the usage for investigators assigned a priority score by DRR reviewers, about 61 percent was by those who received a priority score between 100 and 200 at the site visit, and 31 percent was by investigators who had

TABLE I

ESTIMATED PHS SUPPORT FOR INVESTIGATORS USING GCRCs BY INSTITUTE FOR FY 1978

Institute	Number of NIH Grants and Contracts Awarded to Investigators Using GCRCs	Awarded Dollars (Millions)
National Institute of Arthritis, Metabolism, and Digestive Diseases	650	$ 58.9
National Heart, Lung and Blood Institute	443	89.8
National Cancer Institute	274	37.4
National Institute of Child Health and Human Development	194	19.3
National Institute of Allergy and Infectious Diseases	154	12.8
Other Public Health Sources	125	9.6
National Institute of General Medical Sciences	104	17.0
National Institute of Neurological and Communicative Disorders and Stroke	96	16.2
Division of Research Resources1/	30	2.9
National Eye Institute	24	1.9
National Institute of Aging	13	1.1
National Institute of Environmental Health Sciences	12	1.0
National Institute of Dental Research	9	2.1
Total	2128	$270.0

1/ Exclusive of GCRC Awards

TABLE II

CENTER PUBLICATIONS

Year	Publications	(Publications Involving Outpatients)	Abstracts	(Abstracts Involving Outpatients
1969	2,077		931	
1970	2,341		996	
1971	2,219	(246)	991	(122)
1972	2,462	(411)	994	(168)
1973	2,360	(549)	1,175	(285)
1974	2,789	(786)	1,458	(402)
1975	2,993	(935)	1,510	(496)
1976	3,348	(1,120)	1,626	(661)
1977	3,282	(1,228)	1,752	(721)
1978	3,435	(1,130)	1,962	(743)
1979	3,500 est.	( )1/	2,200 est.	( )1/

1/ Outpatient publications not requested

received a priority score between 201 and 250. Only 10 percent of the patient day usage was by investigators who received a priority of 255 or higher. The 90 percent usage by reviewed investigators whose projects received scores of 250 or better is very similar to the 95 percent recorded for funded NIH and NIMH R01 research grants in fiscal 1976. Analysis of the utilization of outpatient visits gave a similar result. Considering the difficulties involved in doing clinical research, and the importance of clinical trials, which generally receive lower priority scores because of lack of scientific novelty, this comparison suggests the work done on GCRCs is similar in scientific quality to that in the research grants program. A previous study established that the DRR site visitors award essentially the same average priority score (197) for protocols presented by grant-supported GCRC users as the DRG study section members do for these investigators' research grants in the same scientific areas (194), even though the study section score is not made known to the site visitors. The data from these sampling studies indicate that the quality of the work performed on the GCRCs is being effectively maintained by the national and institutional review systems.

Budgetary History

Table III describes a ten-year budgetary history of the program, showing the number of centers, positions and beds, and the appropriation. The inflationary factors in the program have been somewhat greater than those in the general economy during the past ten years. For example, the cost of personnel has increased at an annual rate of 9 percent per year for the past ten years, and is expected to continue at this rate at least through next year.

Hospitalization costs have increased at an even more rapid ratt, averaging over 13 percent. Between 1972 and 1977, these cost increases were somewhat ameliorated by recoveries from the service patient policy, but current analyses indicate that additional revenue from this source cannot be expected without substantially altering the program content and sacrificing program quality.

Typical GCRC

The budgetary makeup of a typical GCRC in 1980 is shown in Table IV.

Relationship of the GCRC Program to the NIH Clinical Research Program

Our analyses indicate that most of the investigators using General Clinical Research Centers are conducting studies sponsored under an NIH grant or contract. It seemed, therefore, of some interest to determine the geographic distribution of beds and outpatient resources in

TABLE III

GCRC PROGRAM, 1969 - 1981

FY	Centers	Positions FTE	Funded Beds	Apportionment (in thousands)
69	93	2,298	1,023	$ 35,004
70	93	2,076	904	35,004
71	82	1,885	881	38,004
72	84	1,867	907	42,181
73	83	1,790	893	41,300
74	87	1,795	877	42,320
75	84	1,732	823	42,619
76	84	1,727	784	42,533
77	82	1,679	755	47,283
78	79	1,706	633 1/	51,946
79	74	1,640	613 1/	51,941
80	75	1,687	600 1/	56,218 3/
81	71 2/			59,486 2/ 3/

1/ Excludes 73 beds used for C patients included prior to 1977
2/ Estimate
3/ Revised

TABLE IV

ESTIMATED AVERAGE CENTER

FUNDED FY 80

8.2 Beds

Personnel	FTE Positions	Dollars (thousands)	Dollar Totals
Professional	1.2	$59	
Administrative	1.5	23	
Laboratory	2.6	42	
Dietary	3.2	42	
Nursing	12.9	204	
Other 1/	.9	19	
Fringe Benefits	18.5%	72	$461.0
Hospitalization			
Routine		$225	
B 581 Pt Days x $151		(88)	
C 261 Pt Days x $151		(39)	
A 1686 Pt Days x $66 (ancillaries)		111	
Outpatient 1018 x 26		27	236.0
Travel			1.7
Supplies, Equipment, Other			35.0
			$733.7
Indirect Cost			49.0
			$782.7

1/ Includes 25.5 FTE Clinical Associate Physicians (CAPs)

relation to the distribution of other grants and contracts for clinical research. The geographic distribution of GCRCs is shown in Figure I.

Unfortunately, there is currently no uniform definition for clinical research. Moreover, there are currently insufficient coded data on the contract program to permit computer retrieval and analysis. Since in 1978 contracts represented approximately 12 percent of NIH awards to medical schools, we felt omission of contracts would not seriously affect the study.

Because there is no uniform code for clinical research, we elected to study all grants which were coded for human subjects research and which were awarded to investigators with a Medical Doctorate (MD).[1] While we are aware that not all grants to MDs utilizing human subjects involve clinical research problems and that some grants to non-MDs would be considered clinical research, we felt that an analysis of HS grants to MDs would give us a reasonable approximation of the intensity and locations of clinical research activity.

We found that in 1979 there were 4376 grant awards totaling, $698.3 million, awarded by NIH to MDs in the U.S. for human subject (HS) research (Table V).[2] The 62 institutions which had 75 GCRCs in 1979 received 3144 of these grants, or 72 percent of the total awarded. Thirty-four institutions without GCRCs had ten or more HS grants totaling $96.0 million, while 203 institutions without GCRCs had from 1 to 9 HS grants awarded to MDs totaling $90.3 million.

We then grouped the HS awards to institutions which had GCRCs according to GCRC priority scores by quartiles (Table VI). It can be seen that the ratio of the mean NIH HSG to MDs dollars to mean GCRC dollars is slightly higher for the top quarter (11.1) of this program than the bottom quarter (7.3), but not strikingly so. Because of this relatively constant relationship, each GCRC award dollar serves nearly the same number of HS grants to MDs at institutions across the whole range of the GCRC program (Figure 2).

[1]Grants prior to November 1975 were not coded for human subjects research. We estimate that 10 percent of the grants were missed in our search due to start dates prior to code initiation.

[2]A more recent preliminary analysis using the NIH Computerized Research Information of Scientific Programs (CRISP) system for 1979 identified 3693 grants totaling $686.6 million and 1327 contracts totaling $180.4 million as involving human subjects. In this analysis the total project was counted as HS research if any part of it involved human subjects

GENERAL CLINICAL RESEARCH CENTERS

FY 1980

Figure I

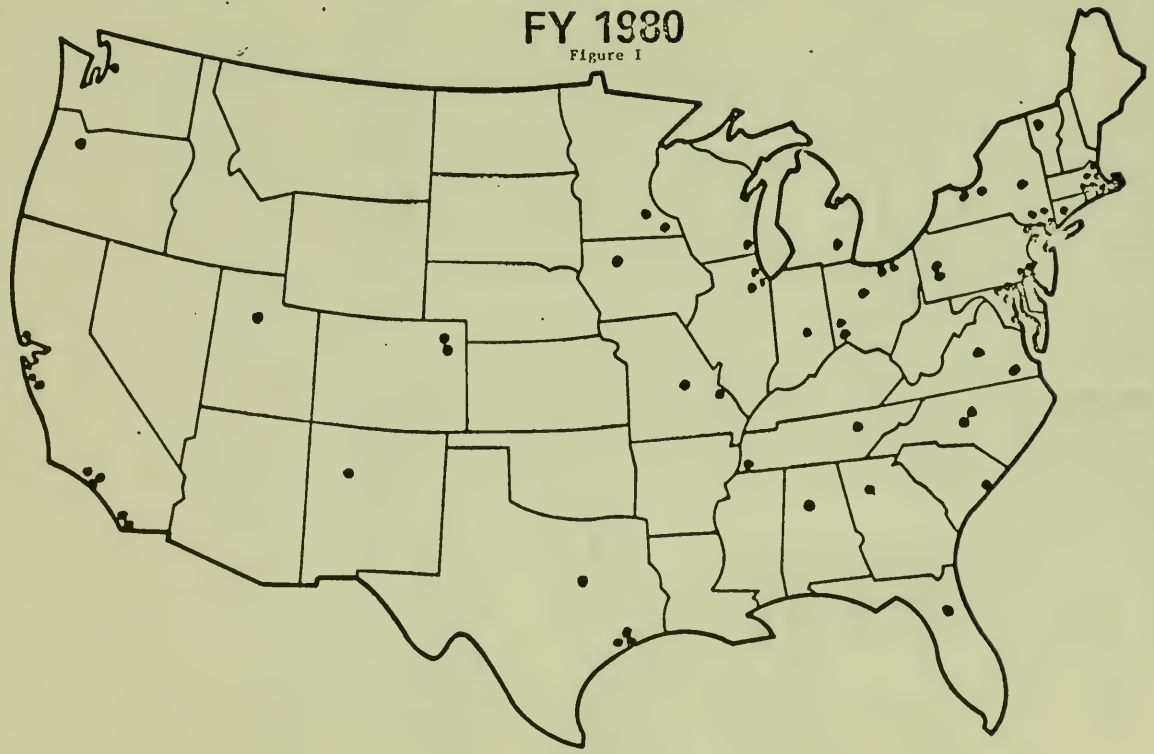


TABLE V

1979 DISTRIBUTION OF NIH HUMAN SUBJECT GRANTS (HSG)

TO MDs BY INSTITUTION TYPES

	Institutions		HSGs to MDs		HSG Funds to MDs	
	Number	% of Total	Number	% of Total	$(Millions)	% of Total
HSG to MDs at Institutions with GCRCs	62	19	3144	72	508.7	73
HSG to MDs at Institutions without GCRCs but More than 9 HSG	34	10	566	13	96.0	14
HSG to MDs at Institutions without GCRCs and Less than 10 HSG	203	61	616	14	90.3	13
Total HSG to MD Foreign	33	10	50	1	3.3	1
Totals	332	100	4376	100	698.3	100

TABLE VI

CRC PROGRAM DIVIDED INTO QUARTILES BY PRIORITY SCORES

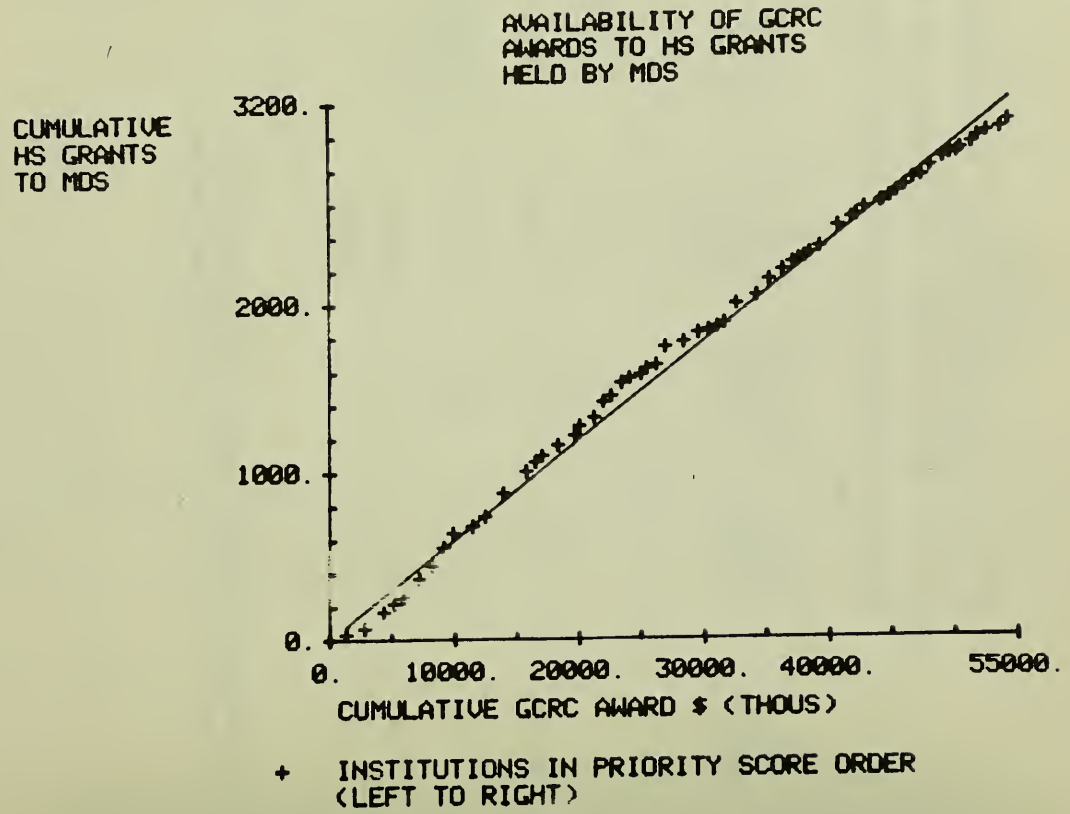
SHOWING RELATIONSHIP OF NIH HUMAN SUBJECTS GRANTS (HSG) AWARDS

DOLLARS TO GCRC DOLLARS AT 62 INSTITUTIONS WITH GCRCs

Quartile of Priority Scores	Rank of Centers Included*	Mean GCRC Award $/Yr (Thous)	Total NIH HSG Awards to MDs $/Yr (Thous)	Mean NIH HSG Awards to MDs $/Yr (Thous)	Ratio $ NIH/GCRC
First	1-16	1135.	201898.	12618.	11.1
Second	17-31	852.	108204.	7214.	8.5
Third	32-49	816.	125821.	7863.	9.6
Fourth	50-62	666.	72739.	4849.	7.3
			508662.		

*Inpatient centers only. Where there is more than one center at an Institution, priority scores were averaged.

Figure 2


AVAILABILITY OF GCRC
AWARDS TO HS GRANTS
HELD BY MDS
CUMULATIVE
HS GRANTS
TO MDS
3200.
2000.
1000.
0.
0.
10000.
20000.
30000.
40000.
55000.
CUMULATIVE GCRC AWARD $ (THOUS)
+ INSTITUTIONS IN PRIORITY SCORE ORDER
(LEFT TO RIGHT)

RESEARCH ACCOMPLISHMENTS

Urea Cycle Enzyme Deficiencies

A new therapy which promises to extend significantly the lives of infants stricken by previously fatal hereditary deficiencies of enzymes in the urea cycle involves the chemical stimulation of alternative pathways for the excretion of nitrogenous wastes. The treatment may be applicable not only to these rare disorders, but also to more common nitrogen-accumulating diseases such as Reye's syndrome, liver failure, and uremia. This work has also led to the important finding that the apparently asymptomatic carriers of a urea cycle disease called ornithine transcarbamylase deficiency, which is associated with severe mental retardation, may have subtle degrees of intellectual impairment.

Diabetes

New data indicate that physical training increases insulin binding and tissue sensitivity to insulin in proportion to the increase in physical fitness. A regular exercise program may therefore have an important role in the management of insulin resistant states.

A gene in the D region of the short arm of chromosome 6 is associated with a high incidence of susceptibility to diabetes. However, studies indicate that more than one gene is involved in susceptibility, and support the idea that a combination of genetic and environmental factors are involved in development of the disease.

Obesity

A possible biochemical explanation has been found for the tendency of people who lose weight to regain it. The enzyme lipoprotein lipase, which removes triglycerides from blood for storage in fat cells, increases to three or more times normal values in formerly obese people who have stabilized at a lower weight after stringent dieting. Enzyme levels seem to remain high as long as weight remains low.

Reye's Syndrome

A factor in the serum of patients with Reye's syndrome interferes with the proper functioning of mitochondria. The levels of the factor have important prognostic implications, as increases and decreases in the serum level are correlated with unfavorable and favorable outcomes respectively.

Alcoholism

Even mild levels of alcohol may result in significant degrees of demasculinization, including impotence and sterility. The sexual dysfunction seems to result from direct toxicity to the Leydig cells of the testes, which produce testosterone, and to sperm, as well as from damage to sections of the hypothalamus and pituitary controlling functions of the testes.

Infectious Disease

Investigations of a family with a sex-linked deficiency of a plasma membrane glycoprotein and a propensity to infection in the affected male members indicate impaired adhesiveness and chemotaxis by the white cells. These findings provide a new lead into understanding one of the body's primary defense mechanisms, the phagocytic leukocytes.

Hemochromatosis

Analysis of the gentotypes of relatives, as defined by HLA typing, together with tests of iron status, have made it possible to identify at an early age those heterozygous carriers of familial hemochromatosis who might have some biochemical expression of the disease and homozygotes who are destined to become clinically affected. The work has clarified the overall mode of inheritance of hemochromatosis and has offered new estimates of its frequency.

Menopausal Symptoms

Hot flashes experienced by post-menopausal women are caused by biochemical events in the brain, particularly sudden large releases of luteinizing hormone (LH) from the anterior pituitary. This suggests that LH, or more likely the factors that cause LH release, may trigger the hot flash. The perception of the hot flash results from sudden shift by the brain of the thermostat of the body, and the subsequent symptoms of perspiration and flushing are automatic cooling mechanisms. These findings suggest a new approach to therapy, involving the use of drugs called alpha-adrenergic inhibitors, which have been shown to block the release of LH in non-human primates.

Pituitary Tumors

Treatment with bromocriptine, an ergot alkaloid derivative, offers the first effective non-surgical therapy for two disorders caused by pituitary tumors, hyperprolactinemia and acromegaly. In hyperprolactinemia, now known to be much more common than previously thought, an excessive secretion of the hormone prolactin causes

abnormal lactation, loss of menses, and sterility; bromocriptine lowers prolactin levels to normal and restores gonadal function. In acromegaly, the secretion of excess growth hormone causes coarsening of features, swelling of soft tissues, loss of gonadal function, and a tendency to diabetes; again bromocriptine helps reverse those abnormalities without adverse side effects.

Infant Epilepsy

A monitoring technique involving multiple methods, including electromyograms, electro-oculograms, electrocardiograms, respiration, and skin electrical responses has been developed to allow investigators to distinguish the serious disorder known as massive infantile spasms from other forms of epilepsy and from normal infant behavior. The method allows for the first time an objective evaluation of the possible efficacy of various drugs in this condition.

CLINFO

The CLINFO System, a computer-based data management system designed for clinical research applications, has been widely accepted by the clinical investigator community. The GCRC program continues to support the three prototype sites at the University of Washington, Baylor University, and Vanderbilt University. The production version of CLINFO, by Bolt, Beranek and Newman, Inc. of Boston, is expected to be installed on seven more centers by December, 1980. The centers where the production version has already been installed (Duke, Hopkins, and Cincinnati) are well satisfied with its operation and find that it is heavily used.

A GCRC Subcommittee on Data Management has been appointed to consider ways to satisfy the needs of GCRCs which desire some capability for data management, but on a lesser scale than the complete CLINFO System (Central Processor Unit, with 4-6 terminals and a System Manager). One of the alternatives under review is the new Digital Equipment Corporation's PDP - 11/23 computer, which is expected to accommodate the CLINFO software and up to two terminals; this configuration would result in appreciable savings. The extent of diffusion of CLINFO next year will depend on the competing priorities within the GCRC program in FY 1981.

A meeting of the System Managers (SMs) from the prototype sites and the seven newly awarded production sites was recently held. The new SMs found that this provided an excellent opportunity to learn from the experience of the prototype SMs. A SM Newsletter will be instituted with the help of Bolt, Beranek and Newman, and a Subcommittee of the SMs was formed to identify possible statistical capabilities that could be added via the "communication file" in the CLINFO System.

Clinical Associate Physician (CAP) Program

The CAP Program, a post fellowship program intended to develop clinical investigators and now in its seventh year, continues to attract candidates of high quality. The National Advisory Research Resources Council has approved two changes in the CAP Program: 1) future CAP applications and continuation requests may include an allowance of $5,000/year for small equipment, supplies, computer time, and travel (up to $800) to scientific meetings, and 2) each grantee institute will be permitted a maximum of two CAPs. If there are separate Adult and Pediatric Centers at a grantee institution (funded either separately or as a single grant) a maximum of three CAPs will be allowed. The salary remains at $30,000 per year. Forty-three CAPs are currently funded at a total cost of $1,382,206. This amount includes salary, fringe benefits, indirect cost, and allowance for equipment (for most recently funded CAPs). The GCRC Program plans to continue the CAP Program with special emphasis as a means of retaining talented young physicians in clinical research.

Clinical Trials

The program is currently undertaking a study of clinical trials through a contract awarded to the Rand Corporation entitled "The Evaluation of the Role of Clinical Research Centers in Clinical Trials, with Emphasis on Information Processing."

The goals of this contract are to: 1) determine how clinical trials of different sizes differ in methodology, computer requirements, and need for support personnel; 2) determine how clinical trials are designed and controlled; 3) evaluate the extent of collaboration, the difficulties (e.g., allowing investigators access to the compiled data base), and how these will impact on the clinical trials performed in CRCs; 4) characterize data management systems used in clinical trials at present, determine what problems are encountered in establishing such systems, and recommend how computer-based data systems can improve the format of a trial; and 5) determine the role of specific aids in administering clinical trials (e.g., keeping records, generating reports, admitting patients).

This contract will be completed in October, 1980, and a final report will be submitted. During the last year of the contract, the contractor interviewed approximately 200 investigators, program directors, nurses, dietitians, administrative coordinators, and other allied health personnel working on GCRCs and being involved in clinical trials. Efforts were mainly put in the area of examining the role of computer-based data management systems to support clinical trials which use GCRC resources and to compare CLINFO functionality and

data capacity to the needs of those clinical trials. According to the modifications of the contract, less emphasis was put on the work tasks which dealt with cooperative efforts among investigators on different GCRCs, access to completed trials data bases, and establishing new data management systems for each trial.

Two presentations resulted from this contract. One entitled, "Trends in Clinical Trials Design", was presented to the Society for Clinical Trials, and one entitled, "Potential Roles for CLINFO and CLINFO Systems Managers in Clinical Trials using GCRC Resources" was presented at the CLINFO System Managers' meeting.

Division of Research Resources Five-Year Plan

In the development of the DRR five-year planning document, the following goals have been established for the GCRC Program:

- Emphasize continuation and promote growth of high quality inpatient and outpatient facilities for multidisciplinary clinical research.
- Provide and maintain mechanisms for developing and supporting clinical research manpower.
- Introduce and develop the placement of appropriate resource technologies for pursuit of clinical investigation.
- Establish administrative management objectives and follow-through for achieving 1) greater intra-institutional awareness of GCRC resources, 2) increased intra-agency coordination with categorical institute programs, and 3) improved operations and utilization of resources.
- Enhance the conduct of clinical trials in GCRCs.
- Expand the base of CLINFO installations to a minimum of two-thirds of the centers.

Administrative Coordinators

At the national meeting of the Administrative Coordinators a one day orientation was presented to new coordinators, in conjunction with the DRR Grants Management staff. Following this, during a day and a half meeting, the entire group reviewed areas involving the overall administration of the center grants.

Nurses and Dietitians

The National Association of Research Nurses and Dietitians, at its national business meeting, conducted a workshop to encourage communication between centers and help participants share problems and solutions unique to research centers. Continuing Education Unit Credits were given to members who attended the workshops.

Biomedical Research Support Program

The Biomedical Research Support Program administers two institutional research grant programs, the Biomedical Research Support Grant (BRSG) Program and the Biomedical Research Development Grant (BRDG) Program.

BIOMEDICAL RESEARCH SUPPORT GRANT PROGRAM

BRSG awards are made to institutions that receive each year at least three allowable Public Health Service (PHS) research grants totalling at least $200,000. The amount of each award is computed by a formula that is applied to the total dollar amount of allowable PHS research grants during the previous Federal fiscal year. BRSG funds are administered by each grantee institution where they are used for those direct costs of biomedical research that are not feasibly supported by other PHS research grants, or that are supported most effectively or at least cost with BRSG funds. The objectives of the program are to enhance the quality of biomedical research, increase its productivity, and reduce its cost.

The major plans identified in the DRR 5 Year Plan for the BRSG Program are:

1. Halt the persistent decline in the amount of BRSG funds, expressed as a percentage of total NIH research grant funds; and increase the percentage to 3.1 percent by 1986. The ultimate goal is to stabilize the BRSG funds at 4 percent, which is far below the statutory ceiling of 15 percent.
2. Halt the trend in which the decline in the amounts of BRSG awards is proportionally most severe for institutions with the largest amounts of PHS research grant support.
3. Develop more analytical measures to express the benefits of BRSG support.
4. Establish a shared instrument grant program in 1982.

A revised formula has been developed to accomplish item two of the 5 Year Plan. The proposed formula has the support of the General Research Support Review Committee and the NARRC. Final approval of the formula is expected in time for computation of the 1981 BRSG awards.

Regional meetings of program directors and BRS Program staff were held in Chicago in October 1979 and Ann Arbor in May 1980. There have been eight such meetings since they were initiated in 1978. Further meetings are being scheduled where none have yet been held.

A Guide to the Biomedical Research Support Grant Program has been prepared by the Research Resources Information Center. The guide describes the purposes, operation, and accomplishments of the program, and provides a list of institutions that received BRSG awards in 1980. Copies will be available for public distribution.

The following tables describe the utilization of BRSG funds, the amounts available, and their allocation to grantees.

TABLE I
FUNDING HISTORY
Biomedical Research Support (BRS) Program (Dollars in thousands)

Year	A Funds Available for NIH Research Grants 1/	B BRS Authorization Ceiling (15% of Funds Available for NIH Research Grants)	C BRS Appropriation	D Column C as a Percent of Column A
1966	$ 604,377	$ 90,657	$ 45,200	7.5
1967	681,197	102,180	51,700	7.6
1968	727,366	109,105	59,700	8.2
1969	729,230	109,385	60,700	8.3
1970	744,061	111,609	57,677	7.8
1971	765,510	114,827	54,200	7.1
1972	901,119	135,168	55,212	6.1
1973	925,457 1/	138,818	60,700 2/	6.5
1974	997,878	149,681	45,149 3/	4.5
1975	1,142,783	171,417	42,957	3.7
1976	1,272,771	184,465	42,957	3.5
1977	1,419,821	212,973	40,873 4/	2.9
1978	1,610,036	241,505	40,873 4/	2.5
1979	1,868,551	280,282	45,021 4/	2.4
1980	2,117,695	317,654	47,516 4/	2.2

1/ Thru 1972 includes NIMH; 2/ Includes 33.5 million impounded funds;
3/ Excludes Minority Biomedical Support Program funds after 1973;
4/ Includes Biomedical Research Development Grant Funds

TABLE II
Distribution of BRSG Awards by Size

Size of BRSG Award (in thousands)	Number of Grantee Institutions				
	FY 1976	FY 1977	FY 1978	FY 1979	FY 1980
Under - $ 30.0	74	94	93	78	108
$ 30 - 49.9	87	89	89	93	89
50 - 99.9	116	115	106	105	101
100 - 149.9	60	69	79	82	102
150 - 199.9	48	37	30	41	106
200 - 249.9	19	51	48	58	--
250 - 299.9	37	--	--	--	--
TOTAL	441	455	445	457	506

Grant Range	Amount				
	FY 1976	FY 1977	FY 1978	FY 1979	FY 1980
Low	$ 17,418	15,565	14,198	14,441	13,449
High	261,305	213,709	200,462	201,413	189,787
Average	96,955	86,754	86,117	91,359	88,271

TABLE III
Total Entitlement* Compared to BRSG Funds Awarded

Fiscal Year	Entitlement*	BRSG Funds Awarded	Ratio BRSG/Entitlement
1976	$ 995,465,535	$42,957,000	4.32%
1977	1,060,171,080	39,473,000 1/	3.72
1978	1,153,259,633	38,322,272 1/	3.32
1979	1,324,013,741	41,751,118 1/	3.15
1980	1,619,308,880	44,654,213 1/2/	2.76

*Total allowable PHS grants used for computation of BRSG awards
1/ Excludes Biomedical Research Development Grant funds
2/ Excludes $400,000 for Minority High School Summer Research Apprenticeships.

TABLE IV
Distribution of BRSG Awards by Type of Institution

Type of Institution	FY 1973	FY 1974	FY 1975	FY 1976	FY 1977	FY 1978	FY 1979	FY 1980
Medicine	104	104	107	106	107	109	109	117
Dentistry	34	33	34	26	27	31	29	30
Osteopathy	0	0	1	1	1	1	1	1
Pub. Health	12	12	12	12	13	13	12	15
Pharmacy	14	12	17	13	14	12	13	20
Veterinary Med.	15	14	15	10	11	10	10	9
Nursing	3	4	5	3	2	4	5	3
Allied Health	1	1	1	0	0	0	0	0
Optometry	0	0	0	0	0	0	1	2
Hospitals	71	66	71	63	61	59	61	61
Health Dept.	2	2	2	2	1	1	2	2
Research Inst.	71	70	75	71	71	67	67	85
Other Academic 1/	113	108	121	134	147	138	147	161
TOTAL	440	426	461	441	455	445	457	506

1/ Academic institutions exclusive of health professional school components.

BRSG awards are used for a wide variety of purposes, some of which are illustrated by the following examples:

BRSG funds provided the original structure and definition for a pilot project at the State University of New York at Binghamton to understand the influence of alcohol on memory processing by humans. Investigators are testing hypothetical interactions between the influence of alcohol and the determinants of memory processing by humans: original strength of the acquired memory, quality of the processing, or circumstances of memory retrieval. Based on their BRSG pilot data, the investigators have now obtained an NIAAA multi-year grant to continue the research.

The BRSG-funded work of an investigator at the University of Tennessee, Knoxville, relates to a question of animal biology--but the findings may eventually lead to the alleviation of certain human diseases. The experiment with marmosets have showed that fetal hemoglobin can be reactivated in the adult bloodstream, opening the possibility that a particular type of hemoglobin made by an individual suffering from a blood disease such as sickle cell anemia can be induced to cease functioning and another type "turned on" to take its place, relieving some of the diseases' painful crises.

At the University of Florida, BRSG funds have been combined with funds from NSF and the University's College of Engineering to purchase an image processing system to automate measurements from ultra high-speed laryngeal films. "Equipment dollars are hard to come by," said the principal investigator, "and the BRSG enabled us to pool money from several sources to obtain a vital piece of equipment." This study concerns a theory of laryngeal vibratory motion and the role vocal cord motion plays in the production of vocal sound. Two applications of the work are the detection of laryngeal disorders and the development of aids for the hearing-impaired to learn to speak more naturally.

BIOMEDICAL RESEARCH DEVELOPMENT GRANT PROGRAM

The BRDG Program is a competitive institutional grant program intended for institutions that have limited health research capability, have significant health manpower training responsibility, are committed to improving and sustaining their health-related research, and offer strong potential for high quality health-related research. The objective is to strengthen and/or expand health-related research in eligible institutions provided it will result in improving the training of manpower for clinical health professions or health-related research or both.

Ten new BRDG awards were made in 1980. The new and continuation 1980 awards total $2,841,787. Twelve BRDG awards terminated in 1980 after three years of continued support. As stated in the annual report last year, no more new awards will be made after 1980. The final continuation grants will be awarded in 1982. Eleven types of institutions have received BRDG awards since the program was begun in 1977.

TABLE V
BRDG AWARDS SINCE 1977

School of Medicine	9
School of Dentistry	3
School of Osteopathy	3
School of Pharmacy	7
School of Veterinary Medicine	5
School of Nursing	2
School of Podiatry	1
School of Optometry	1
Other Academic	4
Hospital	3
Research Organization	4
	42

After two full years of BRDG support, eight of the original twelve grantee institutions had developed Public Health Service research grant support sufficient to receive a Biomedical Research Support Grant (at least three PHS research grants that total $200,000 or more). The attraction of research grant support by the original tweleve grantee institutions is shown in the following table.

TABLE VI
RESEARCH GRANT SUPPORT
ORIGINAL TWELVE BRDG GRANTEE INSTITUTIONS
AS OF 9/77 AND 7/79

Funding Source	9/77	7/79
Public Health Service		
NIH	$437,944	$4,882,690
ADAHMA	171,021	892,314
HRA		9,660
Other Federal		
NSF, NASA, USDA, RDA, VA, OTHER	180,466	1,064,456
State	5,050	120,000
Private	112,283	818,643
	$906,764	$7,787,763

Plans are being developed to evaluate the BRDG Program. The evaluation will determine whether or not significant and long lasting improvement occurred in the biomedical research capabilities of the grantee institutions, and the role of BRDG support in those improvements. The level and duration of the grants, and the uses of the grant funds will be evaluated.

Minority Biomedical Support Program

GENERAL RESPONSIBILITY

The Minority Biomedical Support (MBS) Program is charged with the responsibility of trying to rectify the problem of the underrepresentation of ethnic minorities in biomedical sciences. Resolution of this problem is approached through the granting of institutional awards focused on providing minorities equality of opportunity to engage in biomedical research. The MBS Program supports projects designed to strengthen biomedical research capabilities of institutions with a significant commitment to minorities, and to increase and expand the involvement of faculty and students in biomedical research.

SPECIFIC OBJECTIVES

The overall mission of the MBS Program is necessary as a result of the dearth of minority scientists. Therefore, the specific objectives of the Program are:

a. to increase the numbers and quality of minority biomedical scientists,

b. to strengthen and develop the research setting (eligible institution) in which biomedical research can be conducted, and

c. to broaden the opportunities for involvement in biomedical research by ethnic minority faculty, students and investigators.

The MBS Program provides funds for released time so that faculty may have the opportunity to conduct biomedically oriented research. Equipment, supplies and necessary renovations for approved research projects are supported by this Program. In addition, funds are provided for student participation in research as well as for consortia, collaborative arrangements, special summer projects, and travel to scientific meetings.

In June 1974, the Director of the National Institutes of Health requested that all Bureaus, Institutes and Divisions initiate and coordinate their minority programs activities through the existing minority programs (i.e., Minority Access to Research Careers Program (MARC), (NIGMS), and the MBS Program, DRR. It is through this mechanism that the Intra-Agency Agreements between the Institutes and the MBS Program were forged. Intra-Agency Agreements provide for the transfer of funds from one Institute to another for the purpose of supporting elements in the programs of the receiving institution. In this manner, the Institutes' at NIH can identify MBS subprojects that fit within the scope of the institutes mission and funds are transferred to DRR for support of the projects through the MBS grants.

The purpose of the Intra-Agency Agreements are to place Minority Biomedical Support (MBS) Program investigators in a position to enter the research arena of the cooperating Institute. Via the cooperating agreement, investigators are made more aware of the Institute's research thrust and application requirements and likewise the BID staff become familiar with this emerging talent pool of biomedical researchers.

GROWTH AND SCOPE OF THE PROGRAM

The Program awarded the first grants to 38 institutions in 1972 with a budget of $2 million. The number of grantees has increased to 79 in 1980 with an appropriation of $18.089 million. Included in the appropriation since 1979, is an increase of about $4 million for payment of indirect costs. The grantee institutions had been subsidizing the indirect costs until fiscal year 1979 when the Congress approved and appropriated funds for payment of indirect costs.

Reimbursements (funding of projects) through Intra-Agency Agreements increased from $342,000 in FY 1975 to about $6,035,756 in FY 1980. There has been an increase in the number of projects supported by other Institutes from 8 in FY 1975 to 129 in FY 1980.

With exception of the National Institute of General Medical Sciences and the National Institute of Environmental Health Sciences, all of the Institutes of the National Institutes of Health and the National Institute of Mental Health are participating in these cooperative agreements.

ADMINISTRATIVE ACTIONS

Grantsmanship Workshops

As part of the Program goals to develop faculty and institutional capabilities to engage in biomedical research, the Branch planned and sponsored four grantsmanship workshops during FY 1980. Part of the thrust was to encourage and assist faculty in the social and behavioral sciences as well as the biomedical sciences to write research proposals that would be submitted as components of MBS applications as well as individual grant applications submitted through other channels. Staff recognized the need to provide technical assistance to faculty from minority institutions in preparing high quality research grant applications to improve their competitiveness in the Peer Review process. Several staff members from other elements of the NIH were utilized in the workshops. An agendum was developed along the lines of a mini-course involving at least two NIH staff with each small group of 10-15. The schedule included illustrated lectures on: (1) "Common Problems and Deficiencies Encountered in Research Grant Applications," (2) "Development of a Typical Research Grant Budget", (3) "Understanding the NIH Peer Review Process", and (4) "Overview of NIH Grant Programs".

Each lecture was followed up with small workgroup sessions that examined typical research grant applications selected or designed specifically for the topic to be discussed. Actual hands-on experience in critiquing each portion of an application was provided in the small groups as well as an exercise to develop a budget for a mock application. The objectives and general agenda

are included as Appendix A. Initially, the planning included 5 regional workshops. However, due to travel restrictions and other staff commitments, only four were conducted. A total of about 310 faculty members from MBS grantee institutions participated in the four workshops. The participation was limited to those faculty who had little or no experience in writing research grant proposals or who had been unsuccessful in previous MBS applications. At least one grants officer from each institution also was invited to participate.

Five-Year-Plan

Development of the MBS portion of the DRR Five-Year-Plan was initiated during FY 1979 and was completed during FY 1980. The process involved staff, the Program Advisory Committee and Council workgroups in identifying and prioritizing the future needs and directions of the Program. The planned actions in the three thrusts of the Program were:

1. Student development would involve initiatives to establish predoctoral fellowships, undergraduate summer training away from the parent institution, and coordination with the Department of Education's Biomedical Program to provide summer enrichment opportunities to high school students.

2. Faculty development would emphasize a quick turn around review for short term postdoctoral awards for retraining in special areas. A second initiative for faculty would implement a longer term award such as a research career development award.

3. Institutional development initiatives included visiting consultants for periods of two weeks to two years, facilities development awards as a one-time award for central resources, and establishment of institutional awards to undergraduate women's colleges on a similar approach as the present MBS Program.

Also identified in the Five Year Plan is an overall evaluation for the MBS Program to be launched in 1982.

Collaborative Activities with Other DRR Programs

An agreement was established between the MBS Program and the Biotechnology Resources Program whereby some MBS grantees would be identified as potential users of the PROPHET system. The Biotechnology Resources Program set up demonstrations at the MBS Program Directors Meeting in December 1979 and during the Annual MBS Symposium in April 1980. As a result of the demonstrations and other staff efforts, four MBS grantee institutions submitted proposals for consideration as PROPHET user sites. It is anticipated that all four will be approved and established early in FY 1981.

Another collaborative effort was initiated between the MBS Program and the General Clinical Research Centers (GCRC) Program in assisting with preparation of an application from Meharry Medical College for a MBS grant to develop the clinical research capability of that medical school. If the

application is approved and funded, it would assist the institution in developing the capacity to compete for a GCRC after the initial MBS award. The award would involve co-funding by the MBS and GCRC Programs.

Revision of Policy and Information Statement

The MBS Program Policy and Information Statement was revised and reviewed by program directors and published as an interim version. Included in the policies are newly approved criteria and guidelines for the review committee to use in evaluating investigators, taking into account the variety of institutions in which they are situated. These guidelines will also assist NIH staff in making funding decisions. A copy of the document is attached as Appendix B.

Expansion of the Program

There was an increase in the MBS appropriation for FY 1980 and a mandate from the Congress to expand the Program to institutions not previously participating. Announcements went to all institutions identified as being eligible. Several new applications were received and eight of them were approved and funded during FY 1980, thus expanding the grantee community to 79. Additional expansion occurred by soliciting supplemental applications that included investigators in the social and behavioral sciences. These increased the participation of the National Institute of Mental Health, the National Institute of Child Health and Human Development, and the National Institute on Aging through the Intra-Agency Agreements.

ACCOMPLISHMENTS

Student Participants

In FY 1980 there were 1,027 undergraduates that participated in the Program. The 44 institutions, whose annual reports have been received, reported that 302 MBS students received B.S. degrees. The career choice for the 302 MBS graduates were: 68 admitted to medical school, 27 to dental school, 80 to graduate school, 57 to other health related careers. All MBS graduates from MBS-supported junior colleges transferred to 4-year colleges.

The 302 students also accounted for 300 papers presented at scientific meetings.

The comparable data for FY 1979 which are now complete for 68 institutions that reported are as follows:

1. Total student papers presented - 550,
2. Total MBS graduates (B.S. degree) - 443,
3. Career choices were: 133 to medical school, 118 to graduate school, 21 to dental school, and 118 to other health careers.

The graduate student participants in FY 1980 numbered 372. An estimated 10-15 Ph.D.'s will have been completed by MBS graduate students this year. Only 10 of the 79 MBS grantee institutions have Ph.D. programs. This will bring up to nearly 50 Ph.D.'s awarded to MBS graduate students at MBS

institutions since the program started. An estimated 100 MBS graduate students completed master's degrees in FY 1980 most of these are continuing predoctoral training.

Faculty participants

There are 660 faculty members participating in 480 projects as of the end of FY 1980. The 44 institutions that have submitted progress reports to date indicate that these faculty have made 152 presentations at scientific meetings and published 167 papers in refereed journals. Similar data for the previous year (1978) included 315 publications and 320 presentations.

About thirty current or former MBS faculty participants are currently members of NIH study sections, advisory committees and Councils. This represents almost a doubling of the number in the past two years.

Annual MBS Symposium

The Eighth Annual MBS Symposium was sponsored by the Atlanta University Center in April 1980. About 1,400 participants attended. This year the poster sesssion was expanded to 251 and more students were able to present their research results during the meeting. Several workshops on use of computers and various new research techniques were held for participants. Among the 230 papers presented, were invited presentations by two Nobel laureates and several other well known biomedical scientists. More than 50 graduate and health professional schools had booths for recruiting minority students.

Applications for sponsoring the symposium, in future years, were solicited and three were received and reviewed. The annual symposium will be held in Albuquerque, New Mexico in FY 1981 and 1982.

Minority Biomedical Support Program
Division of Research Resources
National Institutes of Health
Bethesda, Maryland 20205

MBS Grantsmanship Workshops (1980)

OBJECTIVES

A series of five NIH-sponsored regional grantsmanship workshops designed to improve the quality of research grant applications submitted by minority faculty and others who serve (teach/train) large numbers of minorities is proposed. It is expected that this activity will result in more competitive research grant applications submitted to NIH and other Federal and non-Federal funding sources. In addition, the material developed from the workshops is expected to serve as a prototype for bringing minority individuals into the mainstream of Federal funding sources. Workshop participants will be selected from the institutions funded through the Minority Biomedical Support (MBS) Program of the Division of Research Resources (DRR) of the National Institutes of Health (NIH). The MBS Program seeks to increase the number of minority individuals engaged in biomedical research and serves predominantly minority institutions and those institutions with substantial minority student enrollments.

Travel and per diem will be provided for 3 to 5 biomedical science faculty from each MBS grantee institution. Each participant selected should be a full-time faculty member in the natural, behavioral or social sciences, and should have an interest in and the potential for writing a biomedically related research grant. Each participant is expected to disseminate the information/skills obtained to other faculty at his/her home institution.

ACTIVITIES

Major activities include the following:

- the discussion of the common problems and deficiencies encountered in some research grant applications,
- the discussion and critique of a typical research grant application,
- the development of a typical research grant budget and a discussion of associated pitfalls,
- presentations indicating the aspects of successful grantsmanship,
- presentations on the NIH peer review process for research grant applications,
- an overview of NIH programs and introduction of participants to key NIH program managers.

Upon completion of the workshop activities each participant should:

- be able to develop and write a well organized research plan following the revised Form 398 Instructions for NIH Grant Applications,
- be able to develop an appropriate budget for a research grant application,
- understand the peer review process of the NIH,
- have some knowledge about the mission structure and resources of the NIH in order to know where and from whom to get help in developing a research grant proposal.

EXPECTED OUTCOMES

The NIH-sponsored grantsmanship workshops are expected to:

a. produce a pool of 200-300 individuals well trained in grantsmanship skills at predominantly minority institutions and those institutions that serve large numbers of minorities.

b. increase the number of applications for NIH grants from investigators at these target institutions.

c. act as a multiplier in increasing the number of faculty at the target institutions with sharpened grantsmanship skills, through seminars/ discussions by the initial 200-300 individuals at their home institutions.

d. increase the competitiveness of proposals from faculty from the targeted institutions.

e. ultimately increase the percentage of Federal and non-Federal R&D funds going to the targeted institutions.

EVALUATION/EVOLUTION

The overall success of the workshops can only be measured in terms of how successful faculty at targeted institutions are in obtaining grant funds over a period of years. This type of protracted indicator is of limited value in evolving the best prototype for training minority faculty in grantsmanship. Although, we feel that the typical workshop format described in the attachment contains the basic elements for developing successful grantsmanship, it is likely that certain components of the workshops need more emphasis than others and that we have overlooked other components which are vital to the success of being successful grantspersons at the targeted institutions. In order to have the program evolve and become more focused each participant will be asked to rate the various components of the workshop based on importance to him/her in sharpening grant acquisition skills. They will also be asked to suggest components which should be added and/or deleted.

Every attempt will be made to incorporate the suggested changes for each subsequent workshop. Therefore, the workshop content should evolve into a sharply focused prototype based on input from the 200-300 participating scientists.

The fate of research grant applications submitted to NIH by each participant and his/her colleagues at the home institution will be monitored to determine whether there is an increase in the number approved and an increase in the number funded.

Criteria for Evaluating Competing Applications; Levels of Continued Support

The major objective of the MBS Program is to increase the numbers of minority journeymen biomedical researchers. It is also important to emphasize the role of student participants in the research projects.

The present authority for the MBS Program is through Section 301 of the PHS Act as amended. This authority is to fund research and not training. It is, therefore, implicit that the emphasis of the program be scientifically meritorious research projects that involve students as participants in an apprenticeship or on the job experience.

Applications and Funding

The make up of an application must involve research projects with scientific merit as judged by peers in the respective scientific disciplines. Each research project must, therefore, be assigned a priority score on the basis of scientific merit. Appropriate strengths and weaknesses for both scientific merit and student participation (MBS goals) should be developed for each project.

Regardless of all other factors, research projects must be meritorious in order to be supported by the MBS Program. Merit will be determined by the Peer Review process and the level of support for each investigator will also depend on the institutional capabilities and environment.

How are investigators from different types of institutions evaluated, and for how long should they receive MBS support? In evaluating each investigator, it is important to sort out the institutional environment. The MBS grantee institutions offer a variety of environments for carrying out the goals of the programs, ranging from two year colleges to institutions with Ph.D. programs and health professional schools. Therefore, the expectations for investigators in a small undergraduate college or two year college cannot be the same as for those in an institution that awards Ph.D., M.S. and/or Health Professional degrees.

Institutions with graduate programs normally expect their faculty to conduct research as part of their institutional duties. It is anticipated that the institution can provide some support and release time for their research. However, where the support is justifiably inadequate the MBS Program can provide them with some support to carry out MBS goals.

Renewals (Competing Continuations)

Generally, each investigator should expect to be evaluated for scientific merit and productivity, as measured by peers in his/her particular area of expertise. The measures of productivity are publications in refereed journals, presentations at scientific meetings, research grant applications submitted and obtained, and the success of students who have participated in the research in pursuing careers in biomedical sciences.

After an initial grant, investigators at graduate and professional schools should show productivity other than training students. MBS support to such investigators should be sufficient to initiate the project and carry it out to completion. Future support should not have to be at the same level as a previous grant period, but should be expected to diminish as other sources of support begin to flow to the investigator. Support for students, however, would still continue as justified. Future levels of support should be dependent on evidence of efforts to gain other support and productivity.

On the other hand, an investigator at a small undergraduate college, of necessity, must continue to spend a great deal of the time teaching. Therefore, there is a need to continue adequate, but limited, support for a research project as long as the research is scientifically meritorious. Supporting an investigator for the sake of "training" students solely is not within the scope of the MBS Program. The scientific research project must first be judged as meritorious, then the student involvement considered.

In competing for an MBS award, each investigator will, by definition, be reviewed as a new, inactive or active investigator. Upon receipt of an MBS award, each investigator in each category accepts the responsibility of working toward the anticipated productivity outlined in Table II. Investigators who fail to meet the expected outcomes following participation in the MBS Program should be advised by their program directors (in advance) that their subsequent projects may be disapproved.

Recommended Criteria

There is a need for establishing different levels of support for the various classes of investigators, taking into account the home institution, length of previous MBS support, and efforts at productivity.

A guide for comparing MBS support for investigators at different levels of development and at different institutions is included in the attached tables.

These criteria can be helpful in the review of new applications, and also evaluating renewals (competing continuations) and non-competing continuations. They can also be helpful to staff at the time of making funding decisions.

Table I

Expectations of Institutions Accepting MBS Support

Institution	Expected Outcomes
2 year colleges	o Introduction of students to biomedical research; successful transfer of students to 4 year institutions; continuation of career development in the biomedical sciences for both faculty and students. o Faculty should show productive involvement in biomedical research commensurate with the environment (See Table II)
4 year colleges (excluding those with doctoral programs)	o Successful development of faculty involvement in biomedical research. o Institutional support of biomedical research activities and the creation of a competitive research environment. o Minority students having completed degree programs at all levels which involve biomedical research. o Minority student participants on the MBS Program continuing on to pursue advanced study and participation in biomedical research.
Institutions with doctoral programs	Same as for 4 year colleges plus the following: o Production of new knowledge from basic and/or clinical research in biomedical sciences. o Production of minority investigators at the doctoral and post-doctoral levels, o Maintenance of a scholarly and productive environment in biomedical sciences. o Career advancement for existing minority faculty scientists.

Types of Support and Relative Expectations for MBS Investigators — Table II

Type of Investigator	Type of Support Through MBS	Expected Duration Years	Expected Outcome
New	Regular Grant--MBS Project support equipment, supplies, consultantsm technician(s), student research participants, etc.	3-6	a) One to several publications b) One or more research grant applications submitted c) One or more non-MBS research grants funded d) Increased focus in biomedical research area e) Several minority students trained and graduated f) Movement of the investigator into the active category
Inactive	A. Support for renewal or refocusing of research career	1-2	a) Rejuvenated researchers with a sharply focused interest in a biomedical science area b) Evidence of efforts to publish results of research c) Evidence of effort to obtain a non-MBS research grant
	B. Regular MBS Project Support	2-6	Same as a-f under new investigator
Active	A. Restricted MBS Project support (Minor equipment, supplies, consultants. Major emphasis will be on student support; technical support where justified)	Indefinite but on a 3 year funding cycle	a) Several minority students trained and possibly graduated b) Continued research grant applications to non-MBS sources c) Continued and increased publication rate, especially where technical support is provided.
	B. Pilot Project--limited equipment, limited personnel	1-2	a) Completed feasibility study b) Preliminary data acquired c) Applications submitted to non-MBS external funding agencies for research support.
	C. Major Equipment--Partial or full	Once	a) Investigator at a minority institution with state-of-the-art equipment

An individual investigator could conceivably start in the MBS Program as a new or inactive researcher and advance with program support to active status and still continue to receive some level of support

New Investigator - an individual who has received the Ph.D. or completed postdoctoral research within the past 2 years.

Inactive - an individual who has not held a sponsored research grant during the previous 3-5 years and does not qualify as a new investigator

Active - an individual who is presently productively engaged in research and does not qualify under the above categories.

Office of Grants and Contracts Management

The Office of Grants and Contracts Management (OGCM) staff played an important role in the review, negotiation, award making, and the administration of the ongoing grant programs, as well as aiding in the administration of contracts that are made by the Research Contracts Branch, Division of Contracts and Grants. During FY 1980, a total of 854 grant awards in the amount of $166,551,000 and 3 new and 26 contract modifications in the amount of $4,559,000 were made.

There was a substantial increase in the intra-agency activity for the Minority Biomedical Support program. In FY 1980, a total of $6,035,756 was funded by NIH Institutes and NIMH. This is an increase of 31% over FY 1979. This activity resulted in a large workload increase for the OGCM staff.

The following tables and charts reflect the DRR grant and contract effort for FY 1980. Particular attention is invited to the chart titled "DRR Research Grant Awards Fiscal Years 1970-1980 Constant/Current Dollars." In FY 1980, DRR's constant dollars for research grants continued to decrease. It is assumed that in FY 1980 all I/Ds except DRR will continue to show increases in constant dollars for research grants.

DIVISION OF RESEARCH RESOURCES
FY 1980 OVERVIEW OF GRANT AND R&D CONTRACT PROGRAMS (Estimated)

Program	Funding	Major Resources Supported
General Clinical Research Centers Program	$ 56,335,000	• 76 General Clinical Research Centers (Includes one phase out) • Over 2900 Research Projects • 45 Clinical Associate Physicians
Biotechnology Resources Program	$ 17,561,000[1/]	• 45 Biotechnology Resources __ 18 Computer Resources (4 contracts) __ 2 Biomedical Engineering Resources __ 24 Instruments for Biological Structure and Function __ 1 Cellular and Biochemical Material Resource
Animal Resources Program	$ 24,569,000	• 7 Primate Research Centers, including 220 Core Research Projects • 8 Primate Breeding Projects 69 Animal Research and Resource Project Grants and Contracts • Training Programs
Minority Biomedical Support Program	$ 23,925,000[2/]	• 79 Institutions • 480 Research Projects • 660 Minority Faculty, 1,027 Undergraduates, and 302 Graduate Students • Minority Symposium
Biomedical Research Support Program	$ 47,896,000[3/]	• Biomedical Research Support Grants to 506 Institutions • 10,000 Pilot Research/Regular Research Projects • Central Resources • Development Awards to 30 Institutions
Office of the Director	$ 824,000[4/]	• Culture Collection and Research Resources Reporter Contracts
Total Funding	$171,110,000	

1/ Includes $ 807,000 other than DRR appropriated funds
2/ Includes 6,036,000 " " " " "
3/ Includes 380,000 " " " " "
4/ Includes 588,000 " " " " "
$7,811,000

DRR FY 1980 GRANT AND R&D CONTRACT AWARDS BY MECHANISM (Estimated)

(Dollars in Thousands)

PROGRAM ACTIVITY	Research Grants: Research Centers Type	No.	Amount	Research Grants: Other Research Type	No.	Amount	Training Programs Type	No.	Amount	Res. & Develop. Contracts Type	No.	Amount
General Clinical Research Centers Program.....		M01s										
	2	23	$15,494	1	1	$ 68				New		--
	3	21	1,541							Mod.	2	$ 106
	5	53	39,126									
		97	$56,161									
Biotechnology Resources Program.....		P41s			R24s							
	1	4	$ 1,817	2	2	$ 874				New		--
	2	10	2,458	3	2	179				Mod.	9	$2,323 1/
	3	7	498	5	1	436						
	5	23	8,976									
		44	$13,749		5	$1,489						
Laboratory Animal Sciences and Primate Research Program.....		P40s			R24s			F32s				
	1	8	$ 1,087	1	3	$ 158	5	1	$ 21	New	3	$ 315
	2	7	1,349	2	2	67				Mod.	13	991
	3	9	122	3	1	27					16	$1,306
	5	29	3,443	5	4	184						
		53	$ 6,001		10	$ 436						
		P51s			K04s			T32s				
	2	1	$ 2,130	5	1	$ 39	2	2	$ 114			
	5	6	14,001				5	6	508			
		7	$16,131					8	$ 622			
								T35s				
							1	1	$ 13			

DRR FY 1980 GRANT AND R&D CONTRACT AWARDS BY MECHANISM (CONTD)

(Dollars in Thousands)

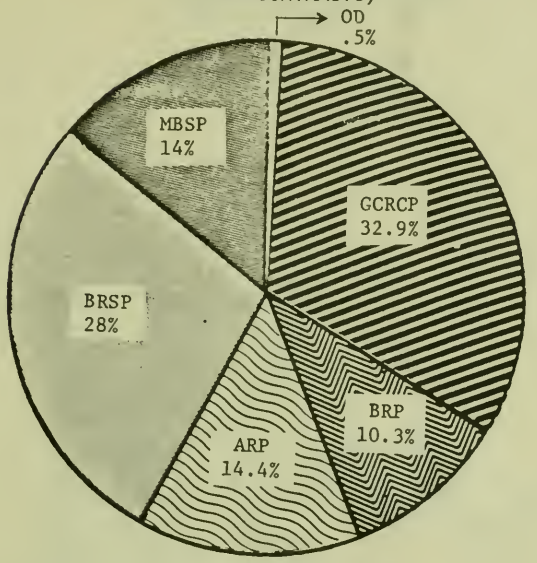
PROGRAM ACTIVITY	Research Grants: Research Centers Type	No.	Amount	Research Grants: Other Research Type	No.	Amount	Training Programs Type	No.	Amount	Res. & Develop. Contracts Type	No.	Amount
Biomedical Research Support Program.....				S07s								
				1	44	$ 1,408						
				2	462	43,646						
					506	$45,054[2/]						
				S08s								
				1	10	$ 1,249						
				5	20	1,593						
					30	$ 2,842						
Minority Biomedical Support Program.....				S06s								
				1	8	$ 2,019						
				2	31	12,233						
				3	11	531						
				5	39	9,086						
					89	$23,869[3/]						
				R13								
				1	1	$ 56						
Office of the Director...										New	--	--
										Mod.	2	$ 824[4/]
TOTAL		201	$92,042		643	$73,853		10	$ 656		29	$4,559

NOTE: EXCLUDES SCIENTIFIC EVALUATION GRANTS

1/ Includes $ 807 other than DRR appropriated funds
2/ Includes 380 " " " " "
3/ Includes 6,036 " " " " "
4/ Includes 588 " " " " "
$7,811

FY 1980* AWARDS BY DRR COMPONENT

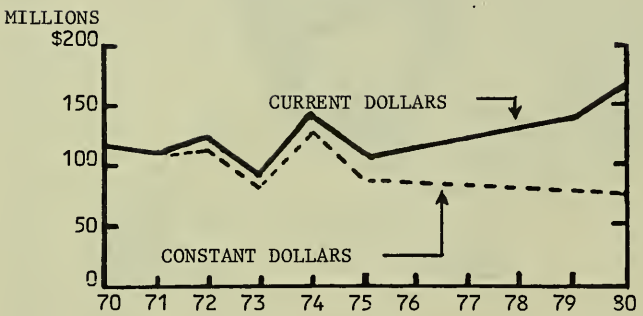
(INCLUDES RESEARCH GRANTS, RESEARCH TRAINING GRANTS, AND R&D CONTRACTS)

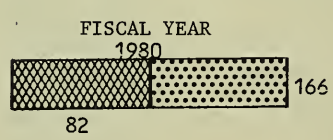


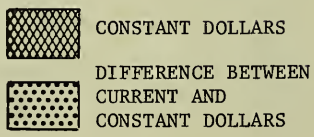
General Clincal Research Centers Program	Research Centers	$ 56,161,000	
	Other Research	68,000	
	Contracts	106,000	
		$ 56,335,000	(32.9%)
Biotechnology Resources Program	Research Centers	$ 13,749,000	
	Other Research	1,489,000	
	Contracts	2,323,000	
		$ 17,561,000	(10.3%)
Animal Resources Program	Research Centers	$ 22,132,000	
	Other Research	475,000	
	Training	656,000	
	Contracts	1,306,000	
		$ 24,569,000	(14.4%)
Minority Biomedical Support Program	Other Research	$ 23,925,000	(14%)
Biomedical Research Support Program	Other Research	$ 47,896,000	(28%)
Office of the Director	Contracts	$ 824,000	(.5%)

*Estimated

DRR RESEARCH GRANT AWARDS
FISCAL YEARS 1970-1980*
CONSTANT/CURRENT DOLLARS







NOTE: BASED ON BIOMEDICAL R&D PRICE DEFLATOR FY 1970=100

SOURCE: NIH, DRG, STATISTICS AND ANALYSIS BRANCH

*1980 ESTIMATED

OGCM FY-1980

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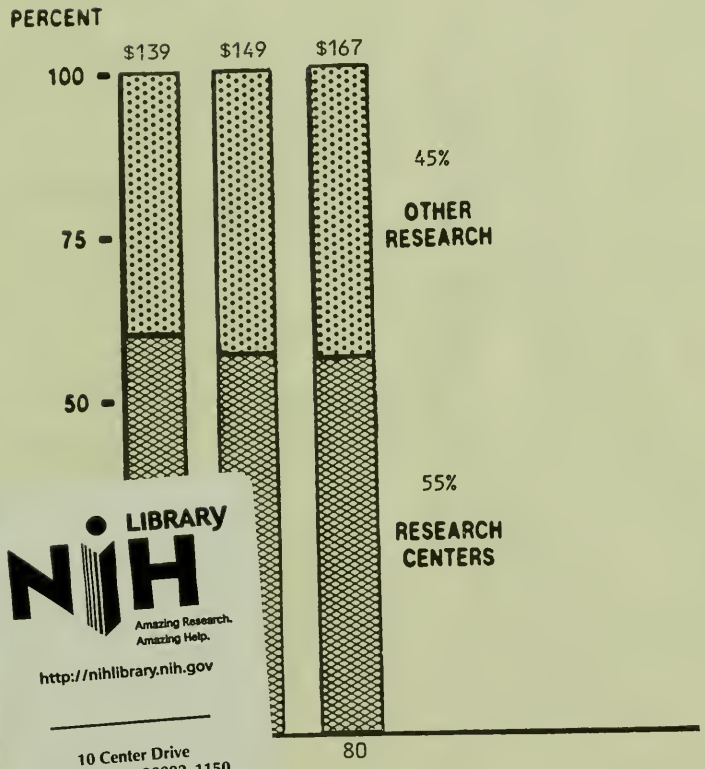
DISTRIBUTION OF DRR RESEARCH CENTER
AND OTHER RESEARCH GRANTS
FISCAL YEARS 1978-1980*

(DOLLARS IN MILLIONS)



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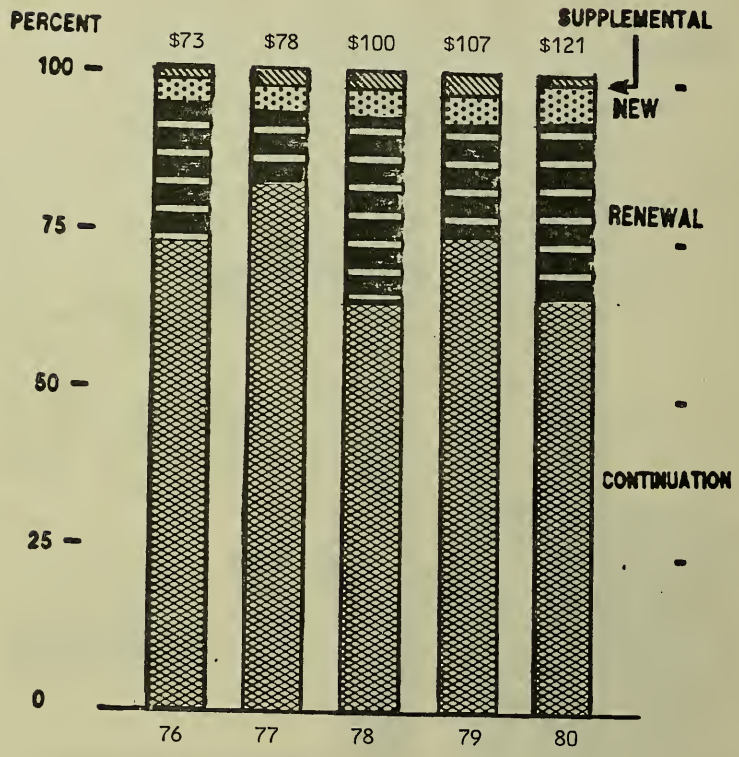
DRR RESEARCH GRANTS BY TYPE
FISCAL YEARS 1976-1980*
(PERCENT OF AMOUNT AWARDED; DOLLARS



NOTE: EXCLUDES BRS AWARDS

*1980 Estimated